E ENGINEERING CONSTRUCTION WEEKLY

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Engineering NEWS-RECORD

August 12, 1937

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• *One of six* Multi Plate arch type sewers being installed in a large midwestern city. The span here is 17 feet and the total length including bends, is 1800 feet. This arch is erected on a concrete base, protected against scouring action by vitrified clay liner plates.

MODERN TYPE OF CONSTRUCTION DEVELOPED BY ARMCO SAVES TIME, TROUBLE AND MONEY

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Besides these superior structural qualities, Multi Plate also assures a high degree of material permanence. Many Armco Ingot Iron sewers, made of 14 and 16 gage galvanized metal, are sound and strong today after *30 years of service.* This same metal in Multi Plate is *3 to 4 times as thick* and the galvanized coating is much heavier. For more specific data bearing on your problems, address the coupon to: Armco Culvert Mfrs. Association, Middletown, Ohio.

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ENR-8

By Which Road?

FROM TIME TO TIME this page has pointed out how important to the national prosperity is the economic unity of the states and commonwealths that compose the nation. Free social and economic intercourse, regardless of political divisions, is a basic principle of the national well-being.

Now a reader writes to ask whether such a view does not justify the trend toward more centralized federal control and imply the suppression of state and regional interests.

To answer that question no mere yes or no will suffice. There can be no doubt that the nation-wide scope and effects of modern business require a commensurate broadening of federal supervision. Today no city, state or region can live unto itself alone; all are profoundly affected by conditions that prevail elsewhere. Modern agriculture, industry, trade and finance are nation-wide: the statutes and regulations required to govern them must recognize that fact.

The matter is one of degree. It is not a question of whether or not; it is one of how much. To recognize the need for national unity is not to acknowledge a need for centralized social and economic authority. To foster social and economic well-being throughout the nation does not imply regulation by federal agencies of wages and prices, of technical and social standards in Massachusetts, Arkansas, Oregon and Ohio. Any attempt to impose such control would not make for national unity; it would make only for bureaucratic domination and substitute political authority for economic process.

NATIONAL UNITY can endure only as the people of each region feel that they have a fair chance to work out their destinies within the national framework. So long as they feel that way, they will rely on the natural forces that govern a system of free enterprise. But once they get the notion that they can invoke some central authority to bestow on them an arbitrary advantage, they naturally will turn to political pressure rather than rely on their own efforts and resources. And just as soon as any region comes to suspect that through ignorance, indifference or prejudice, the central authority disregards its special needs, we begin to reap a harvest of factionalism and disunion.

To conserve national unity we first must have regional well-being. And this must be achieved, not by setting region against region in a political scramble for arbitrary advantage, but rather by keeping as free as possible the natural channels of employment for labor and capital and of trade in goods and services. It is true that in a national emergency federal authority may properly be used to cushion the shocks of dislocation and ease the strains of readjustment. But such interference with natural processes should be recognized as temporary measures and not established as a basis for permanent control. There lies right now one of our greatest dangers.

REGIONAL HANDLING of regional problems and due recognition of regional needs in the formulation of national policies: these are important factors in any recipe for national unity. Another is the requirement that the natural resources of the nation be administered for the welfare of all regardless of where they may be located or where federal funds may be collected. But above all is a recognition of the fact that diverse conditions in various regions may call for different handling of economic and social problems, if their people are to function most effectively within the national economy. Under such a program a regional consciousness does not destroy national unity; it fosters national unity on a basis of mutual benefit.

All this is based, of course, on the presumption that our desire is to achieve national unity *under a democratic form of government*. If that presumption is incorrect, this reasoning cannot apply. Democracy can achieve unity only through the goodwill of the people; the dictator achieves it through the imposition of economic and social control over the people. And when we make our choice between democracy and dictatorship we choose also between a unity of free-will and mutual benefit as against one of federal domination.

Willard Chevalier

ENGINEERING NEWS-RECORD

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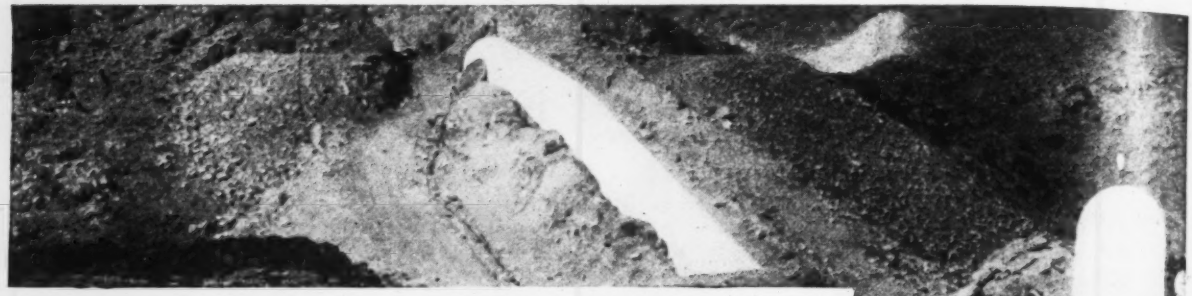

AMERICA'S BIGGEST CONSTRUCTION JOB
$220,000,000 METROPOLITAN AQUEDUCT
USES MONOLITHIC CONCRETE

A bigger job than Boulder Dam, and probably the greatest water supply system ever undertaken, Los Angeles' Metropolitan Aqueduct is an outstanding example of modern engineering genius.

The main aqueduct stretches 240 miles over mountain and desert from Parker Dam on the Colorado river to Cajalco reservoir; five pump lifts totaling 1633 ft.; capacity, *one billion gallons per day.*

In this, as in other great sewerage and water supply projects, concrete plays a vital role. Pictured here is the monolithic concrete siphon at Eagle Mountain pump lift where the water is raised 438 ft. Other sections utilize concrete for conduits, for canal or tunnel lining, or for precast pipe of record size.

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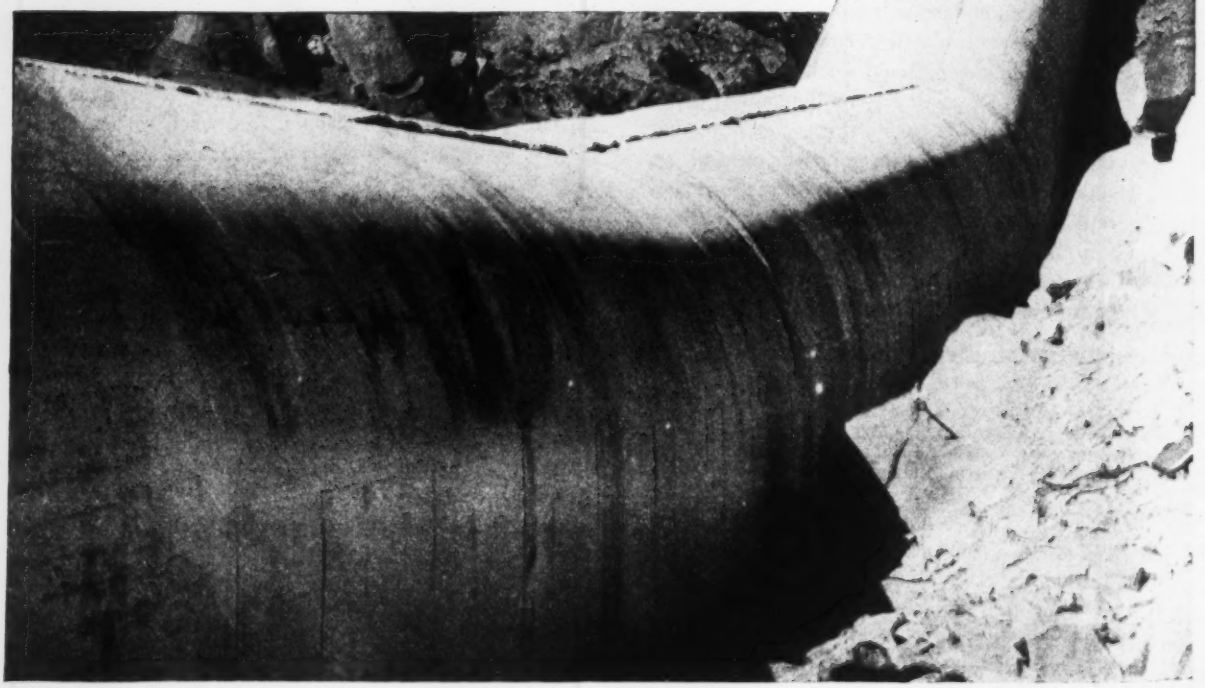
A national organization to improve and extend the uses of concrete through scientific research and engineering field work.



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VOL. 119 *AUGUST 12, 1937* NO. 7

THIS WEEK AND NEXT

BALTIMORE like many other cities has grown up on either side of a river valley which has been appropriated by railroads and industry. Getting highway traffic across this congested area is a serious problem. A few weeks ago the new Orleans St. high-level viaduct over the Jones Falls Valley was described. In this issue the new Guilford Ave. Bridge over the same valley is covered. Taken together these two structures greatly improve Baltimore traffic facilities.

Need for further flood control on the lower Ohio and Mississippi rivers has caused authorities to look to reservoirs for this additional regulation. Arthur E. Morgan, chairman of the Tennessee Valley Authority, discusses proposed and possible reservoirs, centering discussion around the proposed great reservoir at the junction of the Tennessee, Cumberland and Ohio rivers.

Steps to be taken in getting efficient management are given by Mr. Plowman in the second of his articles on waterworks organization.

Lessons learned from one of the first attempts to use asphalt as a binder in jetty construction are given in a report of the failure of the head of one of the Columbia River jetties.

In New Hampshire tarred-gravel surfaces smoothed by road hones are being widely used to provide cheap but satisfactory roads for tourist use. Tools and processes have been brought to high perfection.

THREATENED with a return of desert conditions over a large part of the fertile Central Valley region of California, the state with federal aid has begun work on a great project to supply the water needed to maintain fertility. The first of two articles on this undertaking will be in the issue of Aug. 19.

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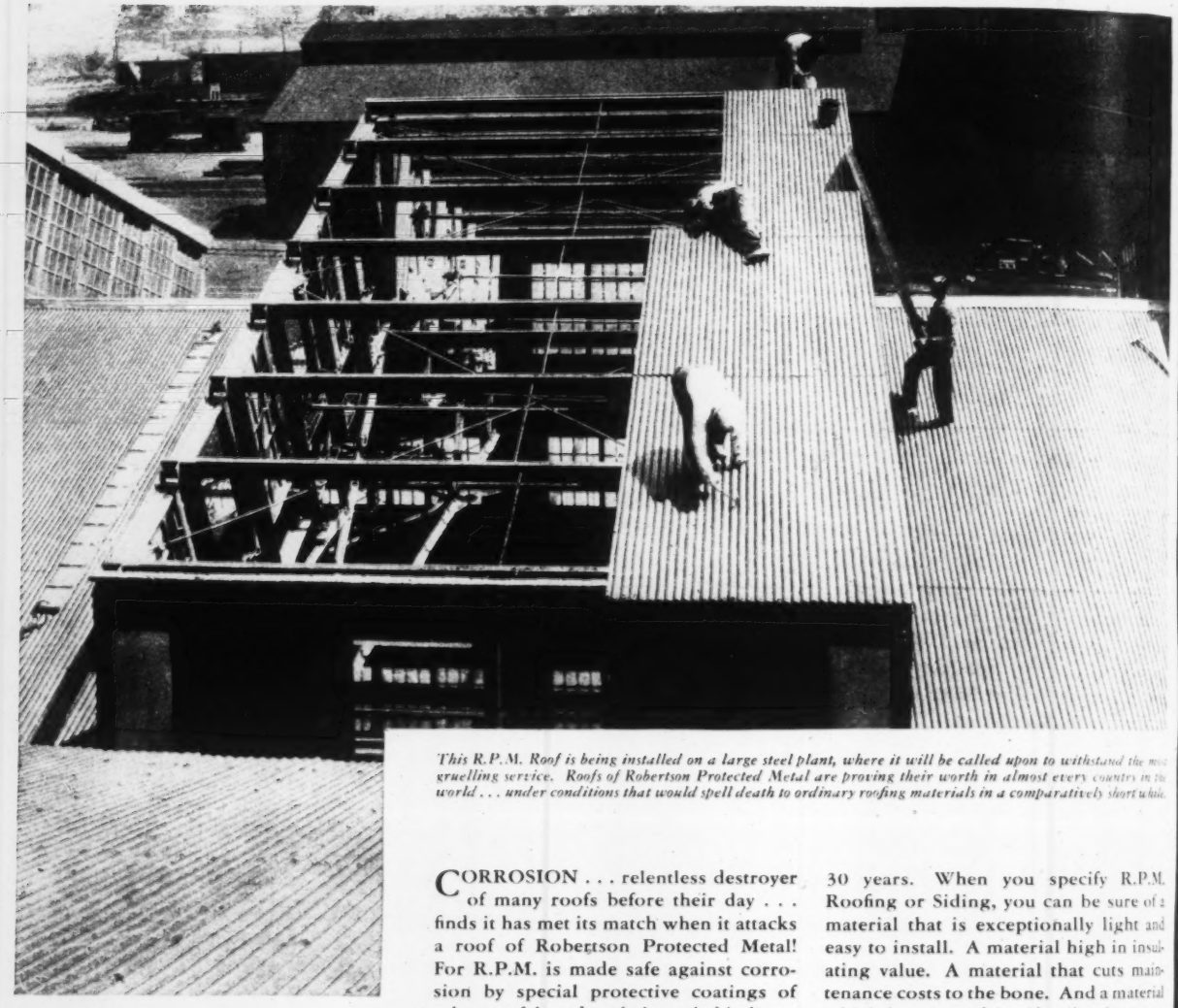
THE COVER PICTURE is of one of the twin tied arches of the new Guilford Ave. Bridge at Baltimore.

Corrosion takes a licking...

WHEN THE ROOF IS R.P.M.!



This R.P.M. Roof is being installed on a large steel plant, where it will be called upon to withstand the most gruelling service. Roofs of Robertson Protected Metal are proving their worth in almost every country in the world . . . under conditions that would spell death to ordinary roofing materials in a comparatively short while.

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Examine the cut-away section of R.P.M. shown on this page. Then get the complete facts for yourself. We invite you to write for our free brochure "Roofs Over Industry." Address H. H. Robertson Co., 2010 Grant Bldg., Pittsburgh, Pa.

ROBERTSON *Protected* METAL ROOFING

THE WEEK'S EVENTS

Housing Bill Passed By Senate

Bill carries amendment restricting expenditures to $1,000 per room

The Senate on Aug. 6 passed the Wagner-Steagall housing bill providing for a $700,000,000 program of low-cost housing construction and slum clearance over a 3-year period, by a vote of 64 to 16. The bill carried a number of amendments drastically restricting the possible scope of the program. Sponsors of the bill hope to remove some of these restrictions when the bill goes to the House.

An amendment introduced by Senator Byrd restricted the cost of construction to $4,000 per family unit or $1,000 per room exclusive of land and slum clearance. Senator Wagner, author of the bill, argued against the amendment that its limitation was so strict that it would not permit construction of housing in populous eastern cities.

Discretion of the Housing Authority was still further limited by an amendment requiring that not more than 20 per cent of the money be spent in any one state.

A further amendment increased the minimum interest rate which the housing authority may charge for loans to local authorities to ½ per cent above the rate which the authority itself pays for money borrowed.

• • •

Bay Bridge Railway System Under Construction

Work on the Interurban electric railway system for the San Francisco-Oakland Bay Bridge got under way last week with the start of work on the terminal building. Bids for the San Francisco viaduct of the railway system are scheduled to be opened on August 18.

Contracts already started include the $1,400,000 railway signal project, of which the General Railway Signal Company is the general contractor, and the sub-structure of the East Bay viaduct and yard, to cost about $700,000, contractors for which are Bates and Rogers Construction Co. Work under the San Francisco viaduct contract will call for the demolition and removal of remaining buildings on the site and 34,000 cu. yd. of excavation, as well as the actual erection of the viaduct. According to estimates, the viaduct will require 3,300,000 lbs. of reinforcing steel, 100,000 lb. of miscellaneous steel work, 100,000 lb. of railing, and 18,400 cu. yds. of concrete.

• • •

Rivers and Harbors Bill Passed by Senate

The Senate on Aug. 5 passed the Rivers and Harbors Bill, sent to it by the House, and increased the authorization provided in the House bill by $15,000,000, from $33,687,000 to $48,760,000. The bill carries only authorization for the project; appropriations will have to be made in another bill.

The projects added by the Senate are mostly small jobs scattered over forty states. Two large projects are included; one authorizes $9,260,000 for the improvement of Calcasieu River and Pass in Louisiana and another authorizes $2,500,000 for the improvement of the Sacramento River in California. Numerous widely scattered preliminary surveys are also authorized by this measure.

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Wage Bill Reported To House

Committee version includes Green amendments reducing power of board

A revised wage and hour bill with restrictions on the powers of the Labor Standards Board which are intended to protect collective bargaining, leaving government work under the Walsh-Healey Act as heretofore, and containing provisions to prevent destructive foreign competition, was favorably reported to the House Aug. 4 by the House Labor Committee by a committee vote of 17 to 2. The proposed amendment which would have permitted the board to set minimum wages as high as 70 cents an hour and as low as 35 per week, is not included in the reported bill.

Green amendments

Seven amendments proposed by the American Federation of Labor, to meet the objections of that body to the bill, are incorporated in the measure now before the house. The first provides that the Labor Standards Board has jurisdiction over wages and hours in an occupation only if it finds that collective bargaining agreements do not already cover a substantial number of employees or that existing facilities for collective bargaining are inadequate, and a second amendment provides that existing wage and hour standards, established by collective bargaining agreement in any occupation, shall be taken as evidence of the appropriate wage and hour standards in that occupation.

It is provided that the Board may not lower wage and hour standards already prevailing in any industry or locality, nor may the board establish any wage or hour classification in any community which adversely affects the prevailing wage or hour standards in that or another community.

Prison-made goods are outlawed in interstate commerce. The provision of the original act which would have required sub-standard goods to be labeled is eliminated.

The final A.F. of L. amendment re-

(*Continued on page 248*)

PROTECTION AGAINST THE WAVES OF THE MISSOURI RIVER

LOWER part of the vast expanse of the upstream face of Fort Peck earth-fill dam is being covered with a layer of glacial boulders as a protection against wave wash of the reservoir. More than 500,000 cu.yd. of these boulders were picked up one at a time off the plains of Montana, hauled to the nearest railroad siding and loaded into dump cars. This view shows a trainload of boulders being dumped from one of the tracks extending across the face of the dam at the berms. Bulldozers spread the rock to place. Millions of yards of riprap for the upper part of the face will be supplied by Snake Butte quarry, opened 70 miles from the dam.

Federal Regulation Plan For Drivers' Licenses

The Senate Committee on Interstate Commerce has reported favorably a bill which would prohibit the operation of motor vehicles in interstate commerce by unlicensed operators. The bill was introduced in the senate by Senator Truman and a companion bill was introduced in the house by Representative Cartwright.

The bill would confine within state borders, under penalty of fines up to $300, operators of motor vehicles in states which do not require drivers to have licenses and to pass an examination which includes at least an eyesight test, indication of ability to read and understand highway signs, and a demonstration of ability to exercise reasonable care at the wheel. In addition, to be allowed to operate in interstate commerce, the operator must be at least 16 years of age and his state must have a provision for revocation or suspension of licenses.

The legislation would not become effective until four years after the date of enactment.

More than half the states, according to the American Automobile Association, would be affected by the Truman Bill. The five states of Florida, Illinois, Louisiana, Mississippi and South Dakota are without any form of license law, excepting the licensing of chauffeurs in Florida, Illinois and Louisiana. The Wyoming law must undergo legislative changes. Eleven states, Alabama, Arkansas, Indiana, Maine, Minnesota, Missouri, Nevada, North Dakota, Texas and Wisconsin, make no provision for a mandatory examination of applicants for licenses. A number of other states, under the operations of the proposed law, would find it necessary to strengthen license laws.

• • •

First Concrete Poured For Parker Dam

The first bucket of concrete was dropped into the deep excavation to bedrock at Parker Dam in the Colorado River, on July 31. Bed rock had been reached the preceding week, 235 feet below the bed of the Colorado.

Parker Dam, 150 miles below Boulder Dam, will divert water into the 392-mile metropolitan aqueduct of the Metropolitan Water District of Southern California. It is being built by the federal government with funds supplied by the water district.

Construction Contract Let For Ruby Dam

Contract for construction of the first unit of the Ruby hydroelectric dam on the Skagit river was awarded last week by the Seattle board of public works to the General Construction Co. of Seattle, the J. F. Shea Co. of Portland, Ore., and the Columbia Construction Co. of Bonneville, Ore. The three firms, bidding jointly, submitted a figure of $3,968,000, the only proposal received at the opening.

J. D. Ross, City Light engineer, had estimated the cost of the project at $3,530,664, but recommended acceptance of the bid to obtain PWA grants.

The contract calls for excavation of foundations and placing concrete for a concrete arch dam from Elevation 1,150 to 1,280. It is planned later to extend the height to Elevation 1,500 and eventually to 1,760.

A change in plans, which has been accepted by the contractor, increases the diameter of the dewatering tunnel from 24 to 30 feet.

A separate $530,000 contract to furnish 276,000 barrels of cement required in construction of the dam was awarded the Superior Portland Cement Co. of Seattle.

THE CURRENT TREND

This week's news of contract volume and construction cost factors

Contract Developments of the Week

Construction awards for the week total $45,348,000, a 3 per cent gain over last week and 10 per cent over the 1936 week. Private construction is 51 per cent above the 1936 week while public contracts are 2 per cent below. This week's total is made up of private, $14,172,000; federal, $7,288,000; state and municipal, $23,888,000.

Contracts for Ruby Dam in Seattle, Washington, boosted the earthwork and drainage classification to its highest weekly dollar volume of the year, $6,670,000. Streets and roads, public buildings, and unclassified construction also gained over last week, but all other classifications lost.

The weekly average of contracts to date for 1937, $19,838,000, is 14 per cent above that recorded at the corresponding period in 1936.

• • •

Meat for the Labor Stew

Mason-Walsh-Atkinson-Kier Co., contractor on Grand Coulee Dam, on Aug. 1 signed an exclusive closed-shop agreement with A.F. of L.

Disgruntled, C.I.O. bulletins the job: "According to the Wagner Labor Act the A.F. of L. must have 51 per cent of the employees in its membership to be permitted to bargain collectively. C.I.O. claims a larger membership than A.F. of L at the Dam. Workmen should know they are protected by the Wagner Act and cannot be forced to join any union."

An official of M.W.A.K. claims: "C.I.O. has only 500 members out of 5,000 employees, and most of the remainder have already signed up with A.F. of L."

• • •

Concrete Pavement

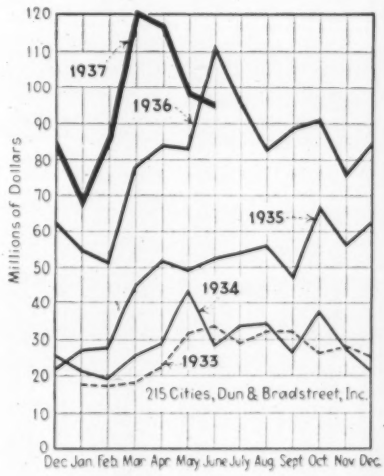
In the following table is given the concrete pavement yardage awarded in the United States during the month of June and the totals for the first six months of 1937. The total is running about 30 per cent ahead of last year.

	Sq. Yd. in June	Sq. Yd. for 6 Months
Roads	4,860,959	20,366,608
Streets	1,621,631	6,067,278
Alleys	92,512	229,392
Totals	6,575,102	26,662,278

Building Permits

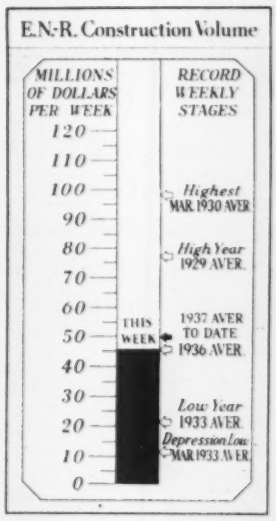
June total is below same month last year for the first time since December, 1934

Building permits in June exhibited what at first glance is a disquieting drop; for the first time since December, 1934, the monthly total is below the comparable figure of a year previous. While this may foreshadow a reversal in the upward trend that has been almost unchecked since 1933, this is not believed to be the case, since a special condition in New York city residential building is responsible for the poor June showing. Last year, in June, permits for private residential construction in New York City rose to the unusually high total of $26,283,000 because of a feverish rush to file plans in the belief that the new building code was going into effect. This June, New York residential permits were more normal, $4,400,000; hence the poor comparison.



THE RECOVERY OF BUILDING PERMITS

Comparing the first six months of this year with the same period last year, the number of residential units is up 40.1 per cent, and the estimated cost, 41.2 per cent; for new nonresidential, the increase in units is 18 per cent and in cost 21.4 per cent. In alterations and repairs the increase in units for the first six months is 13.2 per cent, and in costs, 29.7 per cent, based on Bureau of Labor Statistics figures.



ENR INDEX VALUES

Index	Base 1913	1926
Construction Cost (Aug.1)..	242.95	116.78
Construction Volume (July)	185	81

THIS WEEK'S FIGURES

(Thousands of Dollars)

CONTRACTS

	Week Ending Aug. 13 1936	Aug. 5 1937	Aug. 12 1937
Federal	$12,410	$ 6,749	$ 7,288
State & Municipal	19,495	21,781	23,888
Total public	$31,905	$28,532	$31,176
Total private	9,377	15,509	14,172
TOTALS	$41,282	$44,041	$45,348
Cumulative 1937 (32 weeks)			$1,591,818
1936 (33 weeks)			$1,442,505

Note: Minimum size projects included are: Waterworks and waterways projects, $15,000; other public works, $25,000; industrial buildings, $40,000; other buildings, $150,000.

NEW PRODUCTIVE CAPITAL

	Week Aug. 12	Cumulative
NON-FEDERAL	$24,867	$956,266
State & mun. bonds	3,718	354,586
Corporate securities	21,149	359,706
PWA loans and grants		12,635
RFC loans		29,939
Fed. aid for highways		200,000
FEDERAL		57
TOTAL CAPITAL	$24,867	
Cumulative 1937 (32 weeks)		$ 956,323
1936 (33 weeks)		$1,228,126

New York Costs Higher

Compared with May, June construction costs were 15 per cent higher in New York City, compared with only a 2 per cent increase for the national average of 22 cities, according to the construction cost indexes of the American Appraisal Co. These indexes also reveal a 5 per cent rise for Denver, Seattle and Buffalo. New York's increase is the result of revised labor schedules, representing an average increase of 22 per cent over former rates.

Fraud is Suspected On Boston PWA

Investigators are seeking evidence of large scale collusion on PWA projects

Early last week newspaper stories appeared in Boston and New York dailies intimating that evidence of collusive bidding had been unearthed on PWA contracts as the result of income tax investigations by the intelligence unit of the internal revenue department among certain contractors and politicians. Preliminary inquiries by a representative of the *Engineering News-Record* revealed that these charges are receiving the active attention of both state and federal officials. In governmental circles it was pointed out that the close supervision of PWA projects exercised by the engineering and administrative staffs, including scrutiny of bids and contracts as well as field inspection work, has been generally effective in minimizing abuses. While the existence of collusive bidding was not declared to be impossible by any official consulted, it was indicated further investigation would be necessary.

Searching investigation into the methods of contractors bidding on PWA contracts in Massachusetts is under way at this time with the objective of locating and removing any practices which might be open to criticism. During the past four years PWA has assisted the state and its subdivisions in the construction of $76,454,754 of projects, on which the federal grant has totaled $26,719,353. About 400 contracts have been placed, and the average number of bids on each has been from 8 to 10. It is customary for a representative of the PWA to be present at the opening of all bids, and for grants to be withheld until the PWA administration declares itself as satisfied with the fairness and responsibility of the tenders accepted by the beneficiary of the project. In less than a dozen cases the state administration has found cause of action against contractors for peruring payrolls.

• • •

Wage Bill Reported

(*Continued from page 245*)

moves government work from the control of the board and places it under the Walsh-Healy act as at present.

In the definition of the word "produced" the phrase "in any state" is stricken out so that the whole world, theoretically, is now included. A provision of the bill empowers the tariff commission to study the cost of domestic as compared with similar foreign goods and to impose on raise duties, and to restrict or prohibit certain goods to protect industries affected by the wage-hour standards.

The house committee measure provides that the members of the Labor Standards Board be selected on the basis of region and sympathy. One member of the board must come from the North East, one each from the North West, the South West, and the South East, and there shall be a representative of labor and one of the employers. The board is to appoint a director in each state, and in the District of Columbia.

Twenty-four hour operation of industry is opposed by a provision that the third shift throughout industry, where not necessary, is to be discouraged, and that time and a half is to be paid for third-shift work.

As regards child labor, the reported bill returns to the form originally reported to the Senate, leaving the determination of whether child labor constitutes substandard conditions to the Labor Standards Board. The Senate bill as passed dropped this provision and substituted a flat prohibition of child labor on goods to be passed through interstate commerce.

• • •

Rent Rise on Project Arouses Opposition

An attempt to raise the rental rates on Neighborhood Gardens, a limited-dividend housing project at St. Louis, has aroused protest among the tenants. Petitions protesting the increase and asking a PWA inquiry are being circulated. The final decision as to whether the rents may be increased will be made by the Housing Division of PWA, because it provided $640,000 of the cost of the project. The remaining $102,000 was subscribed by a limited dividend corporation.

The petition states that an increase of about 10 per cent is contemplated and argues that such a proposal is contrary to the intention of congress, that the income of the tenants is limited, and that the increases would be a hardship on them.

J. C. Wolf, director of the project, stated that he could not supply information about the extent of the raises until August 15. He said that the PWA has "practically authorized the increase" but that final word has not been received. He stated that the project, although completely occupied for ten months, has thus far yielded only enough to pay interest charges on the government loan with no amortization payments and no interest payments to the corporation.

Engineer's Union Gets C.I.O. Aid

F.A.E.C.T. receives funds and organizational cooperation from the C.I.O.

Financial and organizational assistance for a nation-wide organizational drive by the Federation of Architects, Engineers, Chemists and Technicians were pledged by the Committee for Industrial Organization at a meeting July 24 between officers of the federation and John L. Lewis, chairman of the C.I.O., the federation has announced. It was arranged that the various national unions in auto, steel, shipbuilding, and transport which are members of the C.I.O. will set up a national supporting committee for this drive, and each union will designate one of their executive officers to work together with the F.A.E.C.T. national executive committee.

Funds were voted by the C.I.O. to permit the federation to add about twelve organizers, editors, and publicity directors to its staff. Funds were also made available to issue a series of pamphlets to point out to technical men the role of the federation and its relation to the production unions.

At a recent meeting of the national executive committee of the federation, it was decided that regional organizers would be appointed to cover Boston, Bridgeport, Newark, Philadelphia, Ohio, Michigan, the Calumet area, Los Angeles and the State of Washington.

National Convention

The third annual convention of the F.A.E.C.T. has been set for October 7-10 in Detroit. In conjunction with the convention, a technological conference will be held to discuss the report of President Roosevelt's National Resources Committee. All engineering and technical societies and associations will be invited to send observers and delegates to the convention.

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Port Authority Income Up 50 Per Cent

The Port of New York Authority has reported that its net income for the year ending June 30 was 51 per cent greater than that for the preceding 12 months. The net total was $5,244,000 as compared with $3,474,000 for the previous year.

The authority expects to advertise a bond issue of about $15,000,000 later in the year to provide for refunding and to carry on construction of the new Lincoln Tunnel.

Bonneville Bill Passes Senate

Bill is nearly the same as House measure putting dam under army

The Senate on August 9 passed the bill setting up a temporary administration for the marketing of surplus power from the Bonneville power and navigation project on the Columbia River in substantially the form in which it had already passed the House of Representatives, but with minor differences that will necessitate sending the bill to conference. In both forms, the bill provides for an administrator who will market the power, setting up the necessary transmission facilities to reach the markets, but leaves actual operation of the dam and power plant in the hands of the Army Engineers. Preference in the sale of power is to be given to public agencies and co-operatives.

Differences in bills

The principal difference between House and Senate bills is that the latter gives the administrator more direct authority over the Army Engineers in power plant operation and the installation of additional units. It also directs the Federal Power Commission to allocate costs to navigation and power, whereas the House bill leaves this to the administrator subject to review by the commission. Other differences are minor. To save time House may accept Senate amendments; otherwise a conference will be necessary to settle the differences.

Boulder rider out

Neither bill carried the rider proposed by the purchasers of Boulder Dam power which would have reopened the matter of rates for energy from that project.

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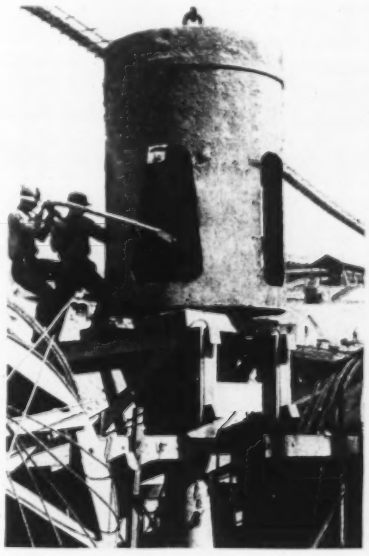
Brooklyn Project Rents Set by PWA

Rental rates for Williamsburg houses, PWA low-cost housing project in Brooklyn, have been announced by PWA, ranging from $4.73 per week for a two-room apartment to $6.61 per week for a five-room unit. Three room apartments will rent for $5.42 and four room apartments for $6.09. In addition to the rent, an overall utility charge covering heat, light, hot and cold water, and electric power for cooking and refrigeration will range from $4.20 a month for a two-room to $5.50 a month rent for a five room apartment.

Selection of tenants by the New York City Housing Authority is already in progress.

The Housing Division has announced that rents set for seventeen PWA slum clearance and low-rent housing projects to date average $5.37 per room per month. The 17 projects include all those on which rents have been set thus far. In addition to the rental charge, a utility charge which covers heat, light, hot and cold water and power for cooking and refrigeration is made on all tenants which averages $1.83 per room per month.

The division reported also that 30 states now have housing authority legislation necessary to participate in slum clearance and low-rent housing projects under the pending Wagner bill.



MILES OF CONDUIT

CONTROL of the low-water flow through Grand Coulee Dam will be through 60 conduits 8½ ft. in diameter, aggregating 2½ miles long. The outlet tubes are so close together that it requires an elephant trunk spout to get concrete underneath them. All conduit forms are built of wood and fabricated in sections.

President Opposes Flood Pacts

President Roosevelt expressed his opposition to the New England interstate flood control compacts in a letter to Governor Cross of Connecticut, August 7. Basing his opinion upon the findings of the Federal Power Commission, (*ENR* August 5, 1937, p. 206), the President stated that "it is my profound conviction that these matters are properly the subject of federal legislation and not an interstate compact."

Staff Changes In TVA

No appointment yet to chief engineer's post vacated by A. E. Morgan

Following reorganization of the Tennessee Valley Authority staff system in May by the appointment of John B. Blandford as general manager, Arthur E. Morgan retired from the position of chief engineer. Although this occurred in June, a successor has not yet been appointed. An order of the general manager now announces the appointment of Sherman M. Woodward as water planning engineer, Theodore B. Parker as chief construction engineer, and Barton M. Jones as engineer of design. These are in effect reappointments to positions heretofore occupied, except that Mr. Jones has been acting engineer of design. The order is believed to mean that all principal members of the engineering staff will, if retained, be confirmed.

Arthur E. Morgan has been chairman of the TVA board of three since the Authority was created in June, 1933, and has also been chief engineer. In this capacity he organized the entire TVA engineering and construction departments and directed the studies of river hydrology and control as well as the design and construction of the several great dams that the Authority has undertaken.

Carl A. Bock, who has been in immediate charge of TVA engineering and construction as assistant chief engineer, is temporarily continuing the direction of these activities. It is reported, however, that he is not acceptable to the two members of the board other than A. E. Morgan, namely, David Lilienthal and H. A. Morgan, and that his continuation as member of the TVA staff is uncertain. Reports that Arthur E. Morgan was not consulted by his fellow members with respect to filling the position of chief engineer are held to emphasize the seriousness of the long-standing split in the board, in which the chairman has been in the minority.

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French Railway Tunnel Opened in Alsace

The 7-mile Vosges Tunnel, connecting the Province of Alsace with the rest of France was formally opened August 8.

The tunnel, which runs from Saintdic to Sainte-Marie-Aux-Mines, is 25 ft. wide and 20 ft. high, but will carry only a single track. The maximum grade in the tunnel is 15 per cent.

Projects Approved For Flood Control

Forty-four million dollars worth of projects approved from 1937 appropriation

Presidential approval has been announced of $44,438,000 worth of flood control projects throughout the country. These projects are financed by allotments from the War Department non-military appropriation act of 1937 and are for projects authorized in the omnibus flood control act of 1936. Of the $44,000,000, $30,000,000 comes directly from the War Department appropriation. The remaining $14,438,000 comes from relief funds in accordance with the agreement made at the time of passage of the $1,500,000,000 relief act of 1937. It was agreed, after amendments earmarking portions of the fund had been dropped, that some of the relief money would be used for flood control work.

The list of projects authorized follows:

FLOOD CONTROL ALLOTMENTS APPROVED

Project	Regular Funds	Relief Funds
Merrimack River	$1,916,384	$550,000
Connecticut River	3,000,000	580,000
Southern New York Projects (Binghamton Area)	1,681,000	2,249,000
Conchas Reservoir, New Mexico	4,000,000	1,000,000
Fort Supply Reservoir, Okla.	1,130,000	155,000
North Little Rock, Ark.	315,000	35,000
Little Rock, Ark.	88,500	22,000
Los Angeles County Flood Control, Cal.	5,000,000	6,478,000
Santa Ana River, Cal. (Design only)	250,000	.....
Pittsburgh Flood Control Project (3 reservoirs), Pa.	3,750,000	256,500
Brevoort Levee, Wabash River, Ind.	733,500	243,000
Middlesboro, Ky., Cumberland River	223,000	52,000
Columbia River Basin, Oreg., levee construction	1,094,883	403,158
Umatilla River, Wash., levee construction	190,000	30,000
Stillaguamish River, Wash., levee construction	134,000	86,000
Puyallup River, Wash. (Design only)	200,000	.....
Cowlitz River Basin, Wash., levee construction	138,748	75,642
Lewis River Basin, Wash., levee construction	138,695	76,080
Willamette River Basin, Oreg., levee construction	520,069	275,940
Topeka, Kans., on Kansas River	600,000	400,000
Glasgow, Mont., on Milk River	12,900	12,900
Forsyth, Mont., on Yellowstone River	40,000	40,000
Saco, Mont., on Beaver Creek	13,400	13,400
Belle Fourche, S. Dak., on Belle Fourche River	144500	14,500
North Little Rock to Gillette (above Plum Bayou), Ark.	400,000	100,000
Newport, White River, Ark.	232,000	55,000
Village Creek, White River, Ark.	340,000	60,000
Lamoille River, Vt.	26,330	50,000
Savannah River at Augusta, Ga.	243,000	144,000
Tar River, N. C.	42,500	47,500
Bolling Field, D. C.	89,000	50,000
Coosa River at Rome, Ga.	250,000	141,080
Bayou des Glaises, La.	191,030	50,000
North Little Rock to Gillette (below Plum Bayou), Ark.	510,000	90,000
Saline Point Cutoff, La.	30,303	.....
Buffalo River, Miss.	20,000	15,000
Big Black River, Miss.	414,000	436,000
Lola, Kansas	23,300	6,000
Skaggs Ferry, Ark.	87,000	13,000
East Side Levee District, Upper Mississippi River at St. Louis	375,000	47,000
Perry County Districts Nos. 1, 2 and 3, Upper Mississippi River	335,000	56,000
Wilson, Wenkel and Prairie du Pont Drainage & Levee Districts, Upper Mississippi River, Ill.	207,000	29,000
Surveys, War Department	500,000	.....
Surveys, Department of Agriculture	500,030	.....
TOTAL	$30,000,000	$14,437,700

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U. S. Wins Duke Case In Appeals Court

The Circuit Court of Appeals on Aug. 6 refused to grant the Duke Power Co. an injunction to prevent Greenwood County, S. C., from building the $2,852,000 hydro-electric plant at Buzzard Roost with PWA money. The Appeals Court decision upheld a previous district court ruling. In its ruling, the Appeals Court held that the National Industrial Recovery Act under which the project was authorized was constitutional.

The Duke Power Case had previously been carried to the Supreme Court, but that body threw the case out for technical errors and remanded it to the lower courts.

At the same time the court refused to grant an injunction against construction by the federal government of the $10,000,000 Bluestone flood control and power project on the New River near Hinton, W. Va., reversing a lower court decision. The West Virginia Power Co., which sought the injunction, had contended that the Government had not been properly authorized by Congress to acquire land by condemnation.

The Bluestone project is part of the comprehensive plan for flood control on the Ohio river. No funds are now available for its construction as the appropriation was returned to the treasury when the lower court injunction was granted.

C.I.O. Disgruntled Over Grand Coulee Pact

Objects to A.F.ofL. agreement but defers strike test, while government remains neutral

The C.I.O., which has been trying to organize workers at Grand Coulee Dam for some time, is objecting strenuously to the agreement signed Aug. 1 between the Mason-Walsh-Atkinson-Kier Co., contractor on the dam, and the A.F. of L. by which the project is to be operated closed shop with sole recognition given unions affiliated with the Federation. A test strike was scheduled by C.I.O. for Aug. 6, but was postponed to Aug. 9 and again indefinitely deferred. Contractor officials report that C.I.O. has only 500 members in the working force out of some 5,000 employees, and they contend the organization lacks the necessary strength to create any trouble.

In the meantime, Secretary Ickes has announced the Bureau of Reclamation will remain "absolutely neutral" in the dispute, and has instructed all government representatives at the job to show no partiality. He points out that the only concern of the Bureau is to see that PWA labor requirements of 8 hr. per day and 40 hr. per week, and minimum wages of 50c. and $1.20 for common and skilled labor, respectively, are maintained.

Commissioner John Page of the Reclamation Bureau, reports that the matter is being considered by the National Labor Relations Board as to jurisdiction, and he expressed the hope that an amicable settlement would be reached before construction schedules were disrupted. Secretary of Labor Perkins is taking the dispute seriously, and has appointed A. P. Marsh, Conciliation Commissioner at Portland, to attempt a mediation of the trouble.

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Ironworkers Strike Settled By Wage Increases

A strike called by the International Association of Bridge, Structural, and Ornamental Ironworkers Union, A. F. of L. affiliate, against the Mississippi Valley Structural Steel Corp. of St. Louis, which has been in progress since June 16, has been ended. The union stated that the agreement terminating the strike grants a nine-cent-an-hour wage increase, a five-day, forty-hour work week, time and one-half for overtime, and recognition of the union as sole collective bargaining agency for the men. Wages before the strike ranged from 45 to 85 cents an hour.

Soft Coal Code Working Soon

Washington Correspondence

Before Autumn the national Bituminous Coal Commission expects to be ready to prescribe reasonable prices for coal and put an end to a period in which prices have been ruinously low. It is pointed out that this does not involve any great increase in present prices, and that five or ten cents a ton in coal means the difference between solvency and bankruptcy.

Attention also is called to the fact that minimum prices the commission is allowed to fix are those that will equal the average cost of production in each price area. No authority is given to provide a margin of profit. Profits would be restricted to the mines in the district that can produce at less than the average price.

The Coal Commission visualizes its work as closely resmbling that of the Interstate Commerce Commission. The ICC attempts to establish reasonable freight rates throughout the country. The coal commission hopes to be able in much the same way, to prescribe levels of minimum prices that are fair to all concerned.

Reports reaching Washington are to the effect that the principle involved in this legislation represents the direction in which the great majority of operators believe the industry should move.

No prices can be fixed until the commission completes its work of establishing what production costs were in 1936.

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Paving Brick Maker Dies

Oliver W. Renkert, president of the Metropolitan Paving Brick Co., and also president of the National Paving Brick Association and the Structural Clay Products Institute, died at Lake Nipissing, Ont., Canada, on Aug. 6, at the age of 59.

Mr. Renkert became president of the Metropolitan company in 1922 upon the death of his brother, Harry F. Renkert, whom he succeeded in that position. Mr. Renkert always was active in the associations of the paving brick and structural clay product industries. He had been president of the National Paving Brick Association since 1931.

During the existence of the NRA he gave much effort to organizing the brick and tile industries under a code. Later he was a leading factor in bringing heavy clay products manufacture together into a single industrial association, the structural clay products institute, and upon its organization in 1935 he was chosen president, a position he continued to hold to the time of his death.

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Interior Bill Becomes Law

President Roosevelt on Aug. 9 signed the Department of the Interior appropriation bill. The President signed, he stated, "with the greatest reluctance" because an allowance for vocational training exceeded by $10,000,000 the $4,500,000 recommendation in the budget. The President intimated that he would not spend the extra amount.

The bill carries appropriations of $44,877,000 for projects of the Bureaus of Reclamation and Indian Affairs, including an appropriation of $13,000,000 for Grand Coulee Dam. Other large appropriations include $1,500,000 for the all-American Canal, $12,500,000 for the Central Valley project, and $2,550,000 for Boulder Dam. The Interior Bill also reappropriates all unexpended balances from emergency allotments and last year's funds.

Appropriation of $13,000,000 for Grand Coulee Dam is especially significant because it means the start on completion of the dam to full height. Only a little over $5,000,000 of the appropriation will be required to complete the foundation, whose cost, including extras and adjustments, is expected to be about $61,000,000 as against the original estimate of $63 millions. The 1935 River and Harbor Act authorized (without appropriation) construction of the high dam and the irrigation project, but later legislation stipulated that the expenditure should not exceed $63,000,000 unless appropriations for a larger amount were made. According to Commissioner Page of the Bureau of Reclamation the present appropriation therefore provides for completion of the dam, and it is planned to let a contract for such completion, with stipulations making the scope of the work contingent upon continuing appropriations. No work is to be undertaken on the irrigation project itself until land contracts are closed and appraisals of land value completed.

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Missouri Safety Bureau To Serve Contractors

The Missouri State Highway Department has announced the formation of a new nuit known as the Bureau of Safety. The bureau will act not only to prevent accidents among employees in the highway department, but also to prevent accidents on work performed by contractors.

WASHINGTON HIGHLIGHTS

Special reports by Paul Wooton

Bureau of Public Roads announced Aug. 10 that a reduction of $250,000 would be made in the $1,676,718 federal aid allotment to New Jersey for the fiscal year just ended because of diversion of state motor vehicle revenues from highway purposes in violation of the Hayden-Cartwright Act of 1934.

A bill authorizing the Department of the Interior to begin work on a Federal reclamation project in the Arch Hurley Conservancy District in New Mexico if investigation indicates feasibility of the project, was signed by the President Aug. 3.

Sumner Welles, under-secretary of state, has been designated by the secretary of state, to undertake personal supervision of all matters involved in boundary or water controversies between the United States and Mexico, particularly those questions which affect water rights in the Colorado and Rio Grande Rivers.

The Senate has passed a municipal bankruptcy law to take the place of the statute ruled unconstitutional by the Supreme Court. The principal change is that the consent of the municipality is now required before reorganization proceedings can be invoked. Two thirds of the creditors must approve a plan before it can be approved by the Courts.

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New Jersey Steel Erectors Call Sympathy Strike

Steel erectors, members of the International Association of Bridge Structural and Ornamental Iron Workers, struck Aug. 9, against 42 contractors in Northern New Jersey, in sympathy with a strike of employees in the contractors' fabricating plants who have been on strike for two weeks for wage increases, a closed shop and other benefits. The erectors made no demands in their own behalf.

A spokesman for the Structural Steel and Ornamental Iron Association, the contractors group, said the employers would make no attempt to fabricate steel in their shops or erect it on any contract job. He stated that the contractors could not grant the workers' demands and compete profitably against non-union shops in Pennsylvania.

COMMENT AND DISCUSSION

Readers' opinions on matters that concern the engineer

Apprentices Needed

Sir: I think your labor survey, published June 24, was a very thorough one and your conclusions are sound. There is no question in my mind but what the labor situation is the most serious problem contractors have to face in the next year and probably the following.

We have experienced a shortage of skilled men, both on union and non-union projects. The failure of the unions to train apprentices for the past several years has had a marked effect in bringing about the shortage of skilled men.

I believe that the biggest need in the labor market at the present time is that of apprentices in the skilled trades, and I hope that the unions are far-sighted enough to see the necessity for opening their doors to young men who must need fill the places of older men who are constantly dropping out, and thus may fill the increasing demand for additional skilled men.

Chicago, Ill. L. C. ROGERS
July 28, 1937. Vice-president,
Bates & Rogers Const. Co.

Beam Deflection

Sir: A subject in structural engineering that will not down is the deflection of beams. During the six months ending June 1, 1937, *Engineering News-Record* alone has found space in its columns for six contributions from as many writers: issues of Dec. 10, p. 828; Dec. 31, p. 939; Feb. 18, p. 274; April 8, p. 529; May 6, p. 677; May 20, p. 753. Attention is here called to two textbooks that have been brought out during this period.

"The Analysis of Engineering Structures," (New York, Longmans, Green & Co.) is a treatise of 554 pages by Pippard and Baker, two British writers of note. The book is remarkable in discarding old and breaking new ground in structural analysis. However, in the section "Deflection of beams" of Chap. 3 the classic double-integration method is followed. Slightly more than a page is given to "Moment area and shear area methods." Of these and specialized methods in general the authors write, "While it is well for the student to be aware of the existence of these methods, he will not usually find them of any great benefit in practice. The straightforward method of determining slopes and deflections set out in paragraphs of Chapter 3 will in all cases give results with little, if any, more labor and with much less liability to error." Somewhat in contrast with this sweeping statement, under "Displacement of beams by strain energy methods" in Chapter 5, is the sentence, "The first theorem of Castigliano gives an alternative method for calculating the displacement of loaded beams to that described in Chapter 3 and in some cases the strain energy analysis has a decided advantage in simplicity."

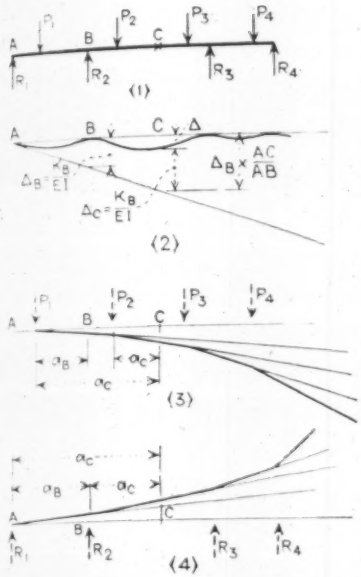
Volume II of "Theory of Modern Steel Structures," (New York, The Macmillan Co.) by Prof. L. E. Grinter is entitled, "Statically Indeterminate Stresses and Space Frames." Chap. 3, "Deflection of Structures," should be read by every instructor of structural analysis. The basic methods for calculating deflections are divided into four groups: (a) Castigliano's Theorem; (b) Virtual Work; (c) Area Moments; (d) Williott-Mohr Diagram (for obtaining truss deflections.) A paragraph of special interest will be quoted: "We find many names given to special applications of the basic methods given here. The terms *elastic weights*, *angle weights*, and *moment weights* have been used in an attempt to clarify the same conception of an angle-load. The name *bar-chain method* has been applied to a similar procedure. The *dummy-load method* is a common name for virtual work when applied to trusses. Even the name virtual work has been an evolution from the original term *virtual velocities*. The titles *method of work*, *elastic energy method*, and others are used to designate what are essentially special applications of Castigliano's theorem."

In conclusion, a personal letter from Prof. James E. Boyd, the author or well-known textbooks, will be quoted: "As for deflection equations, I may be a little prejudiced, but I think that three methods are all that are worth while. These are: the classical successive integration method with arbitrary constants (or between limits) which is pure mathematics with the restriction that $ds = dx$ nearly; area moments, which is geometry; and elastic energy, which is dynamical. Other methods are rather artificial."

New York, N. Y. ROBINS FLEMING,
June 11, 1937

Sir: To find the deflection of a beam at any point even for the case of a simple span is often not an easy matter and for a continuous beam becomes very much more difficult if fundamental methods are used without simplification. Since publication of the article by Odd Albert, "Determining Beam Deflections Without Integration," in the Dec. 10, 1936 issue, your pages have contained a number of interesting methods and formulas avoiding the use of the calculus and its attendant laboriousness. Of these, the simplest and most automatic to use for the case of constant moment of inertia is a formula given by Professor Witmer in the issue of May 6th, 1937 p. 677. In his letter he states that it is applicable to simple spans supporting concentrated loads. The method, however, can be extended to include the continuous beam. That this is true can be seen from the fact that vertical loads may be applied in either an upward or downward direction, and a reaction is equivalent to an upward load. The design of a continuous beam and its supports requires that the reactions be found; having them, the use of this method results in much saving of effort.

Take, for example the continuous beam illustrated herewith, for which all the loads and reactions are either given or have been computed and the deflection Δ of which is desired at point C. The principle of separation of the moment diagram into its component parts or triangles, as outlined by Professor Witmer, is also used. Diagram 3 represents the triangles due to loads and Diagram 4 the triangles due to reactions. If K_3 is the moment of all the component



Applying moment area principle to determination of deflection of continuous beams.

parts of the moment diagram to the left of B about B, and K_C is the moment of all parts to the left of C about C, we have, substituting in the general equation (noting that $\Delta_C = K_C/EI$ and $\Delta_B = K_B/EI$)

$$\Delta = \frac{K_C - K_B \frac{AC}{AB}}{EI}$$

$$\Delta = \frac{(\Sigma Ra_C^3 - \Sigma Pa_C^3) - (\Sigma Ra_B^3 - \Sigma Pa_B^3) \frac{AC}{AB}}{6EI}$$

in which a_C is the distance from C of a load or reaction to the left of C, and a_B the distance from B. This equation follows from the fact that the moment of the triangular moment diagram due to a force, P, about its base, a distance a from P equals $\frac{Pa \times a}{2} \times \frac{a}{3} = \frac{Pa^3}{6}$.

The solution of the equation is simple if tabulation is used, and the form shown has the advantage of keeping the signs straight (upward deflection is positive). Uniform loads may be taken care of by dividing them up into sections and considering each section as concentrated at its midpoint. Point B is any point which does not deflect either upward or downward and for convenience is taken as the nearest support to the end A. It must be borne in mind when using the method that the point A from which the tangent is drawn must be a simply-supported end (free from moment and suffering no deflection).

New York City DANIEL C. DRUCKER
June 19, 1937

Union Issue Discussed

SIR:—Recent discussions appearing in *Engineering News-Record* relative to engineers' unemployment, prevailing rates of pay, desirability of union organization, etc., have interested me. My experience finds me sympathetic with the discussion, but not in entire agreement with some conclusions.

Circumstances may make it necessary for a group of engineers to join an industrial union in order to obtain an improved economic status. In my opinion such circumstances would be regrettable, but the act of joining a union is nothing to feel apologetic about if the common sense of the situation demands it at the moment. So long as the common sense of the situation is the guide to action there would seem to be involved no loss of dignity or professional standing. But to insure that the proper guide to action is not lost sight of, the group interested must keep the initiative and the balance of power in its organization; that is impossible in an industrial union where the engineer-group may be greatly outnumbered by those having other interests and less scrupulous regard for the niceties of method. It appears to me that membership in an industrial union would be disappointing and poor business for engineers in the long run.

According to the economic law of supply and demand rates of pay vary from low to higher, depending on the grade of services offered for sale or hire and the corresponding demand for them. Economic laws and business conditions are circumstances apparently beyond engineering control. Both employer-engineers and employee-engineers find themselves walled in by various circumstances beyond their control.

Like any other citizen, the engineer's status in the community is largely an individual matter; the record of experience and accomplishment the engineer submits to a prospective employer or client is an individual matter; and in my opinion, the bargaining should be carried through as an individual matter, in order to maintain maximum goodwill and the fairest return in the long run. Demand for engineers' services has to be nursed along as well as supply; demand based on business necessities will usually be reflected by low pay rates.

Can it not be said that all a professional attitude requires is to keep in mind the employer's interest during business hours, and perform work so that it won't bounce back and embarass the employer later on? Since most employers and clients are primarily interested in the commercial success of their projects, perhaps engineers would be well advised to make their approach on the basis of being a good investment in engineering talent calculated to improve the commercial efficiency of the employer's project. The employer appreciates hydraulic efficiency, mechanical efficiency, electrical efficiency, etc., so long as they contribute to commercial efficiency, but there is a definite limit to which various engineering efficiencies can be profitably carried. Engineers having the standard equipment of college degree and professional license may be presumed to have a proper appreciation of the various engineering efficiencies. Maybe some of the impatience of the general public toward technical men generally is caused by our pursuit of technical efficiencies beyond the requirements of commercial common sense. The proper appreciation of commercial efficiency is a matter of judgment and experience most likely possessed by the older engineers; the older engineers may be well advised to stress this point in approaching a prospective employer, and concentrate on convincing the employer that judgment and experience are necessary to perform properly the work in the employer's interest.

The above ideas have been gleaned from some twenty years' experience mostly of the employee type, varying from rigger and foreman on construction, to responsible supervision of design and cost estimating. This discussion is intended to be helpful, not authoritative.

Providence, R. I. A. H. DAVISON
July 31, 1937 U. S. Engineer Office

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AUGUST 12, 1937

UNUSUAL FAITH was displayed by Congress in directing the Army Engineers to prepare complete flood-control plans for all principal rivers. No task of this size has ever before been given to any engineering group, or for that matter to the whole profession. The resolution may therefore be considered a tribute to the high regard that the legislators have for modern engineering ability. Unfortunately, flood-control planning of even one river is a highly complex matter, one that calls for long and patient study of conditions, possible solutions, and relative benefits and costs. In the development of the Miami River flood-control project, for example, the studies occupied a large engineering staff for nearly three years, and the Miami is only a little stream and lacks the elements of navigation, conservation and power that complicate many other flood problems. Congress, however, wants similar studies and plans made for all rivers, and, what is more, hopes to have these plans completed in time for a report by January. Midsummer thoughtlessness may be responsible for this optimistic outlook, but whatever the cause the resolution marks a new high in Congressional hopefulness.

Too Much Haste

ASPHALTIC CONCRETE for underwater construction is admittedly in the development stage. It is important to bear this fact in mind when appraising the results of its use for the Columbia River jetty repairs described in this issue. Following the promising experience in consolidating the rock jetty at Galveston (*ENR*, Aug. 20, 1936, p. 263), engineers were tempted to outpace actual progress in technical development in applying the new material to marine construction. Asphalt technologists drew rather more cautious conclusions from the Galveston experiment. It was clear to them that many problems of temperature, placement and compaction, and even design of mixture, remain to be studied carefully. They recognized that much experimental work was necessary to extend the field of construction with asphalt mixtures in unconfined seawater. The experience with the Columbia River jetty strongly emphasizes this conclusion. To conclude that it demonstrates anything more final would be premature. The work so far performed is suggestive, and the initial experience on the Columbia may yet lead to success in producing a coherent and self-adjusting structure rugged enough to resist storm-wave attack.

Highways of the Future

DISCUSSING MAJOR HIGHWAYS of the future, speakers before the American Society of Civil Engineers at Detroit agreed on one point, though they differed on many others: A wide right-of-way must be provided even though little pavement is laid now. Charles F. Kettering, head of General Motors Research, emphasized this conclusion when he said that the best the highway engineer can do is to plan intelligently for the future and provide the permanent road elements that once fixed cannot well be changed. To accommodate the expected 50 per cent increase in the number of motor vehicles within twenty-five years the necessary road capacity must be set aside now. These views, which have many times been expressed in these columns, are so logical as to be inescapable. But with the need for adequate right-of-way and an alinement laid out for future requirements there is equal need to protect this right-of-way against paralysis by roadside uses. How this can be accomplished most effectively is still under discussion. Everyone recognizes, however, that methods of protection must be found and put into practice, for experience proves conclusively that even the best location and road plan are rendered almost valueless when mushroom roadside growth transforms the highway into a village street.

A Job Well Done

SIX YEARS HAVE PASSED since the need of combating the threat of economic collapse by a great national reemployment campaign began to be realized, four years since the Federal Emergency Administration of Public Works was set up to meet this need. After only two and a half years of active operation the PWA was placed in liquidation, but in that short time it solidly established itself as a well-managed construction organization and an efficient economic rescue agency. It functioned in business-like manner, with good judgment, fairness and integrity. It relieved the paralysis of construction and, by priming the pump of industry and business, helped to check deflation and to restore confidence. Everyone who came in contact with it knows how well it carried out its mission and will warmly endorse what Farley Gannett says in this issue of the PWA's administrative and technical management. Everybody knows, too, how serious was the time lost at the start of this work in 1933, and knows that if the country's public works had been mobilized two years earlier a vast amount of suffering and destruction could have

been avoided. On the record it is certain that public-works construction will be a powerful means of fighting the next depression and that engineers and contractors, whose performance in PWA work gave proof of their competence, will be there to lead the fight. They as well as the entire PWA organization can look back on a job well done.

Control of Great Floods

GREAT FLOODS of the Mississippi have long been known to come mainly from the Ohio, largest water-contributor of the lower river. Because of this fact, Arthur E. Morgan in discussing Ohio River storage possibilities makes an important contribution to prevention of major flood disasters. His outline of a promising opportunity for control of the Ohio points to the need also for broad restudy of the Mississippi's problem.

Coming just ten years after the unprecedented flood of 1927 and the resulting decision to make flood control a national undertaking, the Morgan discussion is exceptionally appropriate. The present year was to see the completion of the 1928 project; the present year also brought the first crucial test of the works constructed, and proved that while they performed in highly satisfactory manner they are not enough to give the valley its expected and promised assurance of security from flood submergence.

As to the Ohio, his statement needs no amplification. Headwater storage, which alone has been considered in the recommended control plans, is of uncertain value; there is grave doubt of its dependability in great storms, like that of 1937, the more so because cooperation of an extensive reservoir system is exceedingly difficult to obtain. In contrast, downstream storage catches all the flow and permits immediate adjustment of control measures to the situation at the critical point below. Discovery that large diversion storage can be had close to the Ohio's mouth therefore puts a new face on the Ohio problem. Similar possibilities may exist farther up on the main river, to protect such points as Cincinnati and Louisville, and due prudence requires that they be investigated thoroughly.

The principles set forth by Dr. Morgan challenge much of the recent propaganda for remote headwater control, which has greatly confused the issue of stream protection. Granting that ultimate conservation of river resources would require holding back at the source for utilization all water, even the runoff of extreme floods, this ideal can probably never be approached; certainly for large rivers and great floods it is very far beyond present possibility of accomplishment. The fact is that storage for flood control must be as close as possible to the region to be protected, where it will impound the excess flow of the whole area above and permit of instant regulation as demanded by conditions below. When days or even weeks are required before regulation at the point of storage becomes effective, as in the case of most headwater storage, flood control is a hazardous gamble.

It is with respect to the Mississippi, however, that the discussion of flood control is of greatest weight. Dr. Morgan asserts, in brief, that the Jadwin plan is inadequate, that more protection is required, and that, since the levees already are at maximum height, further reliance must be on reservoirs, and these principally downstream.

In support of his views it may be said that since last February the Jadwin plan has been known to be obsolete. The harrowing events of that time—when the entire valley was mobilized in the flood fight, when whole communities fled to high ground and plans were being laid for forcible evacuation of the entire valley—demonstrated the magnitude of the risk of overtopping the levees. Yet the 1937 flood, though ten per cent short of the design "superflood," brought the protective system close to failure at many points, and in view of the nature of the storm it was soon recognized that at least fifteen per cent more than the superflood should be provided for.

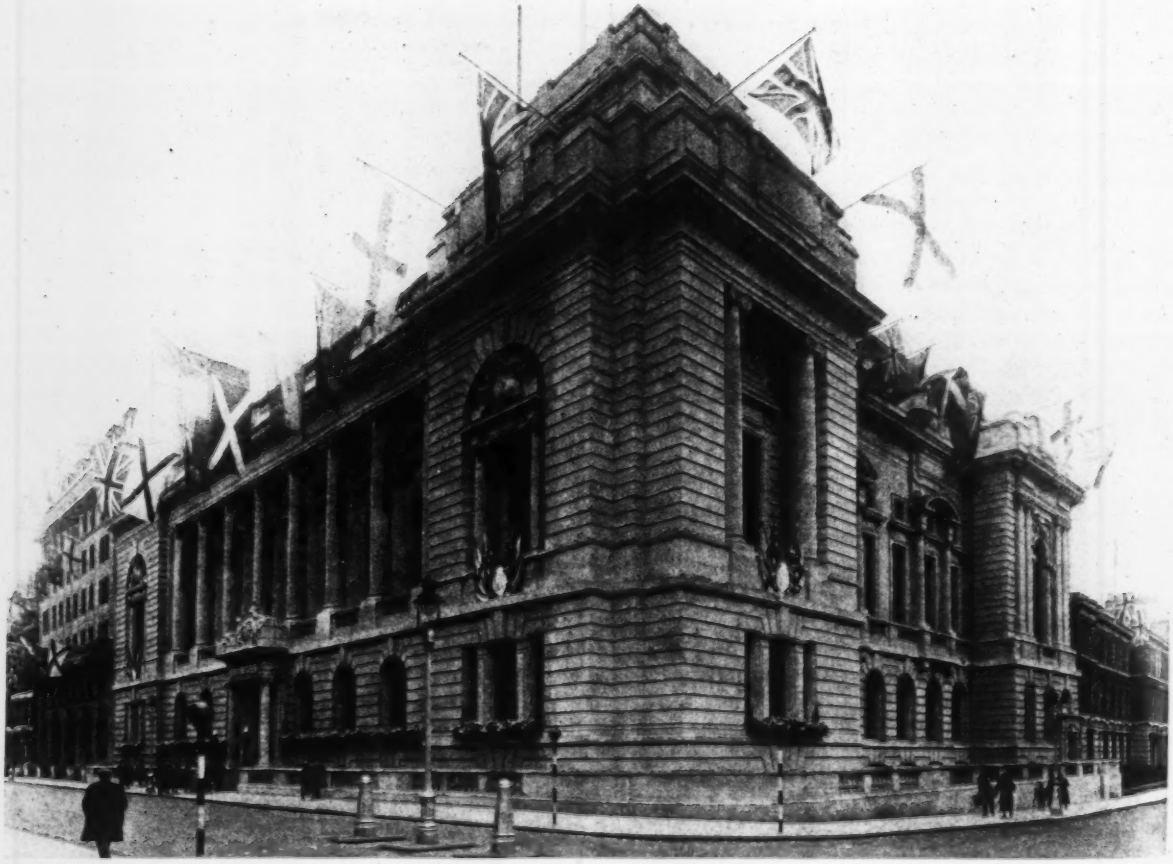
In the opinion of so highly qualified a witness as the Chief of Engineers himself, further levee-raising is out of the question. Channel straightening, brilliantly applied by Gen. Ferguson, offers little further aid. The same is true of diversion floodways, which moreover are now in particularly questionable position because of the bitter hostility that has developed against them. Thus the possibility of large downstream storage becomes a vital point in the Mississippi Valley's safety, and the Ohio-Tennessee-Cumberland scheme described by Dr. Morgan claims especially careful study.

Reservoirs, which now appear as the primary means for making the Mississippi control system safe, were disregarded in framing the 1928 project plan. But already reservoir systems that would cost many hundreds of millons of dollars have been recommended, essentially all headwater storage. The merits of downstream storage now justify careful investigation. If on the Ohio downstream storage of similar capacity to the proposed headwater storage can be built at similar cost, it has claim to serious consideration.

Comprehensive reexamination of the entire Mississippi River problem in the light of these new conditions would strengthen the technical foundations of the Mississippi River control and at the same time would restore public confidence, much shaken by the past year's events. The declared national purpose to make the valley safe against any chance of flood devastation deserves to be carried out, with the full resource of present knowledge and engineering skill.

PICTURES IN THE NEWS

A NEW PLANT *with a capacity of 200,000 tons of tin plate is under construction at Birmingham, Ala., as an addition to the extensive steel mills of the Tennessee Coal, Iron & Railroad Co., a subsidiary of the U. S. Steel Corp. The plant will be completed early next year.*



COMPLETED HOME *of the Institution of Civil Engineers in London. Removal of a building occupying the corner in the foreground has permitted the widening of Princes St. (now Rennie St.) and the completion of the Rennie St. facade of the Institution's headquarters, begun in* 1910.

SIMPLICITY IN MEMBER MAKEUP AND FRAMING CHARACTERIZES THE GUILFORD AVE. BRIDGE IN BALTIMORE

Twin Tied Arches for Baltimore Bridge

by O. H. SCHROEDL

Designing Engineer of Bridges, Department of Public Works, Baltimore, Md.

Attractive appearance being a primary consideration, and the use of existing piers a necessity, a tied arch design was a logical choice

ONE OF THE OUTSTANDING recent bridge improvement projects in Baltimore has been the replacement of two 55-year old pin-connected truss spans over the Pennsylvania Railroad on Guilford Ave. with a modern steel tied-arch structure, also of two spans and on the old foundations. The decision to replace the old bridge gave the city authorities an opportunity to improve both the utility and appearance of this crossing and at the same time to make it more safe for the ever-increasing traffic passing over it. While utility and safety are always primary considerations of a bridge designer, in this particular instance the desire to build a structure that would harmonize with the general features of the location and present a pleasing and truly modern appearance was by no means secondary. The new bridge, it is hoped, is a contribution toward the general improvement of the city. It is also of engineering interest in several of its technical details such as its three-hinged design, its arch rib section, its rigid top lateral system and its interlocking steel channel deck.

Old iron bridge

The replaced structure, completed in 1880, and known as the North St. bridge, was composed of two through pin-connected Warren truss spans, each 173 ft. 9 in. long and 30 ft. deep, with the trusses spaced 36 ft. apart and resting on granite ashlar masonry. The top chords were hollow octagonal sections of cast iron, abutting on cast-iron joint boxes and held in place by a 3-in. projection of the boxes into the hollow of the chords without any fixed connections. All other members of the trusses were made of built-up sections or eye-bars of iron. At the end pins, vertical cast iron posts connected to a top strut and to an extension of the top chord formed the portals, which were quite ornamental. Diagonal rods, together with struts on the longitudinal centerline of the bridge, formed the top and bottom lateral bracing. There was no sway bracing. The roadway, 33 ft.

Fig. 1. Old spans which were replaced were interesting Warren trusses with hollow cast-iron chords and end posts.

wide and carrying two electric railway tracks, was originally constructed of two layers of timber planking laid on timber joists supported by iron floorbeams. Two timber sidewalks of about 11 ft. clear width outside of the trusses were carried on cantilever extensions of the floorbeams.

The bridge had undergone numerous repairs during its half century of service. The first major repairs were made in 1910, when steel stringers were substituted for the wood joists in the roadway, and wood block paving on timber planking was placed in the area between the curb and the rails, while the area between the rails was covered with two layers of planking. In 1916, both sidewalks were reconstructed with concrete, and their clear width was reduced by 3 ft.

Major alterations were again made in 1920, when the distance between tracks was increased 1 ft., an additional line of stringers was added to each side of the roadway (existing stringer positions being shifted to give proper spacing), and the entire roadway was paved with wood blocks on a 4-in. sub-floor. In 1930, the concrete curbs and parts of the sidewalk slab were replaced with new concrete. At other times miscellaneous parts were replaced.

Numerous accidents, caused by vehicles skidding on the wood block paving in wet weather, occurred on the bridge. This troublesome condition, together with the serious swaying of the trusses and the vibration and rattling of truss members, forced the city officials to take some remedial action. This action was further hastened by the danger that a truck might strike and dislodge the end of one of the inclined end posts, which abutted on cast iron joint blocks similar to the top chord, and thus might cause the span to collapse. Dislodgment of the top chord members was likewise possible as a result of a collision with other truss members. An inspection of the bridge and a study of the feasibility of strengthening it to carry modern highway loads safely was therefore ordered in September, 1934.

The results of this inspection and study indicated that it would be feasible and economically sound to renew the entire floor system but, because of the obsolete design of the trusses, no practical and satisfactory means of safely connecting the top chords and end posts to the joint boxes could be found. In the light of these facts, together with the high estimated cost of making the renewals and alterations to a bridge nearly 55 yr. old, it was recommended that the superstructure be razed and a new one erected on the existing masonry.

Choice of type

The Jones Falls Valley, in which the Pennsylvania Railroad is located and over which the Guilford Ave. bridge spans, is also crossed by other bridges in the immediate vicinity to the west. Mt. Royal Ave., a broad thoroughfare extending along the south side of the valley, is lined with apartment houses and hotels on one side and a public park on the other side. The Pennsylvania railroad sta-

Fig. 2. A 40-ft. roadway accommodates traffic on the new Guilford Ave. bridge and a high sidewalk fence with wire glass panels protects pedestrians from high tension wires underneath.

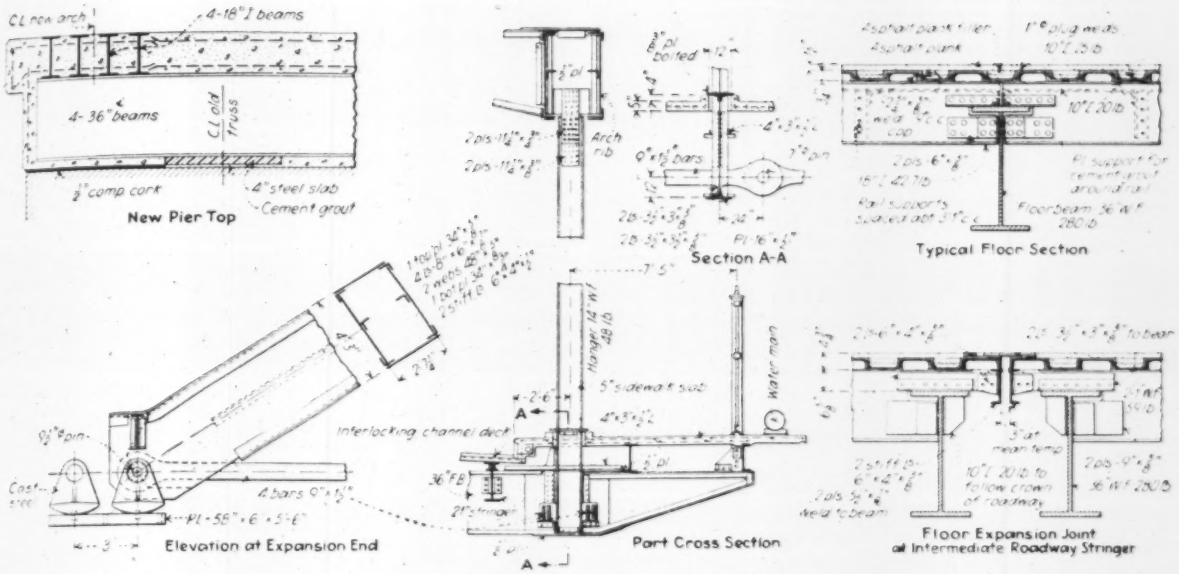


Fig. 3. Structural details of the tied arches of the Guilford Ave. bridge.

tion, the U. S. parcel post station and numerous business houses are also situated in the immediate vicinity. All of these buildings make a rather pleasing general appearance and are viewed daily by the thousands of passengers traveling in automobiles and buses along Charles, St. Paul and Calvert Sts. and Guilford Ave. Esthetic considerations with respect to the new bridge were, therefore, of primary importance. Since the Calvert and St. Paul St. bridges, immediately adjacent to Guilford Ave., are through bowstring truss spans, it was logical to make the new bridge harmonize with these structures. Accordingly it was decided to adopt a design of the same general appearance, that would at the same time express modernity, strength and security.

The steel arch was selected as the type which would admirably satisfy these requirements. Since the existing substructure was to be used, the new bridge would necessarily have two spans of tied arches of the same length as the old ones. A three-hinged, instead of a two-hinged, arch was chosen because of the greater ease of computing the stresses, the elimination of temperature stresses and simpler erection. Inherently, the two-hinged arch is the more rigid, but for a 174 ft. span the difference in rigidity is of no consequence.

The alterations to the substructure were rather simple and consisted, generally, of squaring up the west corner of the north abutment and east corner of the south abutment, of reconstructing the bridge seats and backwalls on the abutments, of placing new copings on the wingwalls and of altering the top of the center pier. These changes were made with reinforced concrete, except that ashlar masonry, to match the old work, was used to square up the abutment corners. Several cracked stones in the center pier were replaced and all of the joints of the abutments and pier were thoroughly cleaned and repointed.

The work done to the top of the center pier was unusual enough to warrant mention. The distance between the arches of the new bridge is 45 ft., which is 9 ft. greater than the distance between the trusses of the old bridge. The axis of the pier is normal to the axis of the bridge, but the railroad tracks are skewed and were relocated and electrified just a short time before the bridge reconstruction was started. The track on either side of the pier clears the face of the nearest pier nose by a minimum allowable distance. There is also a 64-in. sewer under the track on the south side of the pier, one side of which was built against the face of the west nose. These restrictions made it practically impossible to lengthen the pier sufficiently to accommodate the shoes of the new arches. It was therefore decided to resort to the use of a steel grillage supported on the pier at the centerlines of the old trusses and cantilevered on each end to support the new shoes. The grillage is made up of four 36-in., 250-lb. beams, as long as the pier, supported by two 48x74-in. bearing plates 4 in. thick. On top (Fig. 3), four short 18-in. 45-lb. beams were placed under the centerline of each of the new arches. After all beams were in place, they were encased in concrete securely reinforced with steel rods, some of the rods passing through the webs of the beams to tie the entire mass together. A composition cork sheet ½ in. thick was placed on top of the old masonry, outside of the 4 in. bearing plates, to prevent a transfer of load to the pier nose when the beams deflected. A simple coping was formed on the top of the concrete encasement to give the pier a more pleasing appearance.

Arch design

The new superstructure has a roadway 40 ft. wide accommodating two electric railway tracks and there are two sidewalks 5 ft. 8 in. wide outside the arches. The east sidewalk slab is cantilevered 3 ft. beyond the fascia stringer to support a 10-in. cast iron water pipe. A terra-cotta conduit for cables, 3 ducts high and 9 ducts wide, was constructed under the west sidewalk. Both spans of the bridge are fixed on the abutments and all expansion is provided for at the center pier. Each span is on a grade of about ½ per cent to provide for drainage either

way from the center of the bridge.

The arch spans were designed in accordance with the 1931 specifications of the American Association of State Highway Officials for an H-20 highway live load and 40-ton electric railway loading, with the exception that the unit stresses were increased to a basic 18,000. Copper-bearing structural steel is used throughout. The arch ribs are box sections 2 ft. 10 in. wide and 4 ft. 4½ in. deep, built on a parabolic curve with a rise of 29 ft. or one-sixth of the span. This form of section (Fig. 3) was chosen because of its great stiffness, plain and neat appearance, and the feeling of strength which it creates. A bottom plate, with elliptical holes 17 in. wide on about 4 ft. 5 in. centers, is substituted for the conventional lattice system. A part of the section of this plate is assumed to carry stress and is included in the make-up of the arch rib. Diaphragms were placed in the planes of the hanger webs and normal to the arch axis at the mid-panel points. A stiffener angle, extending between the diaphragms, was placed on the inside of each web plate.

Rigid top laterals

A top lateral system of simple and unusual design resists all lateral forces on the arch ribs, thus relieving the hangers of lateral bending stress. Each cross strut, made of a plate and four angles, is 2 ft. deep in the center and has a horizontal top flange and a parabolic bottom flange whose curve meets the bottom flanges of the ribs into which it frames; the web of the cross strut is in the plane of the hanger webs. The lateral system diagonals are made of 14-in. 48.-lb. beams, their top flanges flush with the tops of the struts. The connecting plates are cut out on tangent circular arcs between the members which they connect. The hangers are designed to take only vertical loads and consist of 14-in. 48-lb. sections connected at the top to the arch diaphragms with web splice plates to minimize resistance to angular changes between the hanger and arch in the plane of the latter. The bottoms of the hangers are riveted to the floorbeams and sidewalk brackets.

The arch tie consists of four eyebars, 9x1½ in., in two-panel lengths, connected by 7-in. diameter pins (9½-in. dia. at the shoes). These bars pass through openings in the webs of the floorbeams and sidewalk brackets, and rest on shelf angles to prevent sagging. This type of tie was chosen to eliminate secondary stresses which would be set up by the deflection of the arch and the elongation of the tie, if the tie were rigidly connected to the hangers. An effort was made to substitute an H-section for the eyebars, but no practical means was found of accomplishing what was desired.

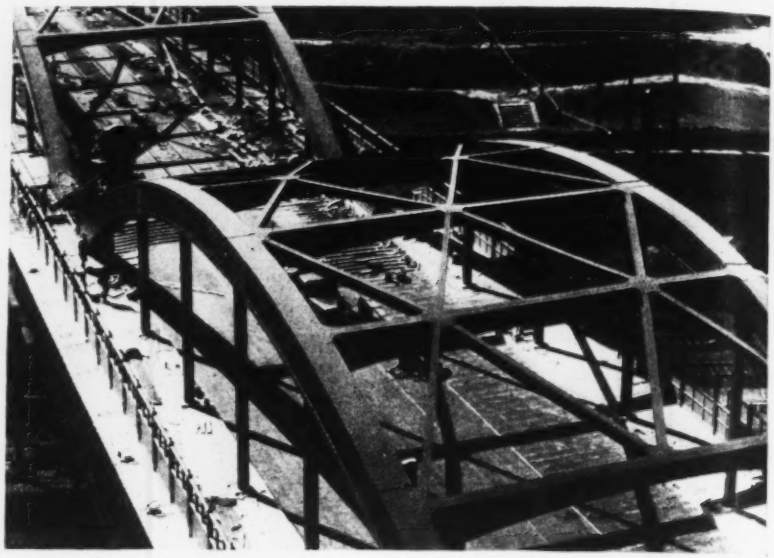


Fig. 4. Constructing the interlocking steel channel deck which is surfaced with asphalt plank. The unusually rigid upper lateral system is shown in the foreground. The steel deck makes a bottom lateral system unnecessary.

All floorbeams are 36-in. 280-lb. sections. Each of the four electric railway rails is supported by a stringer composed of two 18-in. 42.7-lb. channels spaced 12 in. back-to-back and connected by diaphragms 3 ft. apart that carry the rails. The two roadway stringers on either side of the track area are 21-in. 59-lb. beams. All of these track and roadway stringers are framed into the webs of the floorbeams with their top flanges extending over the latter to form a uniform support for the deck.

Full live load on the span causes the arch tie to elongate about ½ in., creating undesirable tensile stresses in the stringers. To overcome this condition, the two roadway stringers on each side of the track area are provided with expansion bearings on the floorbeams at the expansion end of the span; the ends of the four track stringers, however, are riveted. This arrangement sets up bending stresses in the floorbeams and tensile stresses in the track stringers, but they are small and can safely be neglected. The intermediate sidewalk stringer is a 16-in. 40-lb. beam resting on the cantilever brackets, with provision for sliding at one end similar to that of the roadway stringers. The fascia stringer is a 15-in. 33.9-lb. channel. At the third-points of each panel a 6-in. 22.5-lb. H-section is connected across the bottoms of the sidewalk stringers to form a support for the railing posts and the conduit.

Steel roadway deck

The roadway deck is made of welded interlocking steel channels, plug welded to the tops of the track and roadway stringers, on which is laid a mineral-surfaced asphalt plank 1½ in. thick, with an asphalt plank filler in the channel troughs. This type of floor, in addition to being lighter, has an advantage over the conventional reinforced concrete slab with a sheet asphalt wearing surface, in that it can be more quickly laid and opened to traffic. This feature was of major importance and more than offset the additional cost of the channel floor. A further advantage of the interlocking channels is their lateral stiffness; by being securely welded to each other and to the stringers, they form a large horizontal girder, thus making the conventional bottom lateral system for short spans unnecessary. Bottom laterals, then, are omitted.

The sidewalks are reinforced con-

crete slabs 5 in. thick built integrally with reinforced concrete curbs. The openings in the slab through which the hangers and arch ribs pass are surrounded by a curb 4 in. high. Steel plates, connected to the steelwork completely close all openings in the sidewalk slabs to prevent the accidental electrocution of anyone who might drop a metallic tape or wire through an opening onto the high tension electric wires underneath. A ½-in. preformed cork expansion joint is placed in the sidewalk slabs, at each panel joint, to prevent unsightly cracking of the concrete.

Unusual guard fence

The guard fence on the bridge is of a very unique design. At the time of the electrification the Pennsylvania Railroad raised the railings of all bridges over its tracks to a height of 6½ ft. and substituted closed railings for open ones. A solid fence is not a very desirable feature on a city bridge, so it was agreed to use polished wire-glass in the upper 2½ft. of the fence on the new bridge, thus affording pedestrians a view of the valley. An attractive design of posts and panels was worked out. A section of the fence 3 ft. long floats between the end fence posts of the two spans over the center pier, with ample clearance to provide for the expansion and contraction of the superstructure.

Hazardous construction

Erection of the bridge was not unusual with the possible exception of the precautions taken to guard the workmen from high-tension wires. Timber bents were set between the tracks and supported long I-beam grillages on which the timber blocking was placed to carry the superstructure. A solid deck of timber planking was also placed on the beams, extending far enough beyond the sides of the new superstructure to permit the construction of solid fences, 6½ ft. high. All falsework had to be at least 1 ft. 2 in. above energized wires.

All of this work was done from the tracks below. The heavy railroad traffic, the large number of tracks with switches and crossovers, and the maze of wires, made the work extremely slow and tedious. The work was further complicated by a long steel trolley wire support situated directly beneath the north span, the top of which cleared the underside of the span by only 3 ft. All wires that might have been contacted while the falsework was being erected were temporarily de-energized and all bridge steel was thoroughly grounded. The difficult nature of this work, combined with the hazards to the railroad traffic, added a substantial sum to the cost of the new bridge.

The amount bid for each of the various items was as follows:

Removal of old bridge..	$3,000.00
Alterations to substructure	24,405.34
Superstructure	142,097.00
Guard fence	16,245.08
Total	$185,747.42

The weight of steel in the superstructure, exclusive of that contained in the interlocking channel deck and the guard fence, is 775 tons.

Personnel

Plans and specifications were prepared by the bridge division of the city bureau of highways, George Cobb, highways engineer, H. F. Lucke, Jr., associate engineer and O. H. Schroedl, designing engineer of bridges, and under the general direction of B. L. Crozier, chief engineer of the department of public works.

As the city had no appropriation for doing this work, the Maryland State Roads Commission agreed to finance the work out of PWA funds and to award the contract and supervise the erection. The American Bridge Co. was the contractor.

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Payment of Engineer's Fee Denied Because of Faulty Contract

FRED COBB, an engineer, was retained by the City of Norman, Okla., in connection with its paving contracts for various special assessment districts. His contract of employment, however, did not include any specific fees or salary and the special assessment costs which formed a lien against property benefited in each assessment district did not include any sum allocated for his services. He failed to receive any payment and he sued the city to recover fees for services rendered. The suit was dismissed as the court held he had been negligent in not including in each special assessment district procedure the estimated costs of his services.

The court ruled that each property owner assessed for the paving had a right to have the engineer's fees added to the construction costs and that the law made no provision for his payment from the city's general funds, unless the city held a special election to vote him the payment he demanded. His contract with the city was dated in 1923, but the construction work was delayed and the engineer's demand for payment for services rendered was presented to the city for the years 1929 and 1930. Suit was not commenced until 1932 in the county court, which decided against him, and on appeal the supreme court upheld the trial court. (Cobb vs. City of Norman, Okla. 64 Pac. (2) 902; decided Feb. 2, 1937.)

The decision in this case indicates that one deals with a municipal corporation with due notice of its limitations to contract for services or supplies. A special assessment district within a city is a separate corporate entity with limited powers apart from the city which supervises the district. Usually the officers of the district are the statutory officers of the city and this leads to the presumption by many citizens that the city and the district are identical but such is not the usual rule.

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More Power on the Saguenay

THE TWELFTH hydro-electric unit of 45,000 hp. capacity is being installed in the Isle Maligne power station at the head of the Saguenay River in Quebec. This brings the power of that great station up to 540,000 hp.

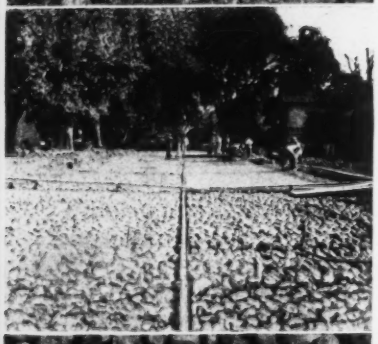
This power station at the outlet of Lake St. John was put into operation in 1925 with eight units installed and space for four more. Other units have been installed since that time and the present installation will complete the plant.

Cemented Telford Pavement

by M. H. Small

District Engineer, Portland Cement Association, Kansas City, Mo.

Cheap street paving is accomplished at Neosho, Mo., by laying field stone as Telford and binding and surfacing them with chats concrete

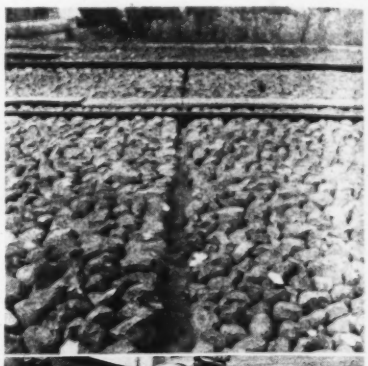


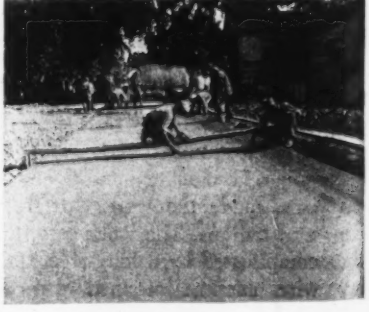
A LOW-COST rigid pavement using local materials, developed by Robert N. North, contractor, is being laid on several Neosho, Mo. streets. Field stone is obtained directly from the fields or stone fences, and there are large chat piles nearby which furnish ½-in. mine-run chat. The field stones, 4 in. to 6 in. in size, are gathered by hand and placed like Telford on a prepared subgrade. The chat is used as coarse aggregate in a 1:2:3 concrete using 7 to 7½ gal. of water per sack. This concrete is dumped directly upon the stone and full penetration is easily obtained due to the large voids; the cement factor averages 9.8 per cent. Visual inspection only is needed to check the penetration.

The surface is finished about 1 in. above the maximum-size coarse aggregate (6 in. maximum for a 7-in. pavement) and finishing consists of tamping with a wood template, crowning with a wood hand screed and belting; curing is by any of the approved concrete paving methods.

On current work on 35,000 sq. yd., the pavement is 26 ft. wide and 7 in. thick. Over part of the area the curb and gutter are in place, and elsewhere a 3 x 14 in. lip curb, using 10-in. steel side forms, is placed immediately after the final belting of the slab. One-half of the width of the pavement is poured at a time, making a construction joint in the center; transverse expansion joints every 25 ft. are of ½ in. bituminous premolded filler. This joint is temporarily held in place and backed up by a 2-in. header board.

Adjacent property owners are furnishing the equipment and material, which average 56c. per sq. yd. The total cost of the completed pavement is $1.80 per sq. yd. of which 76 per cent is for WPA labor and 24 per cent for materials and equipment.





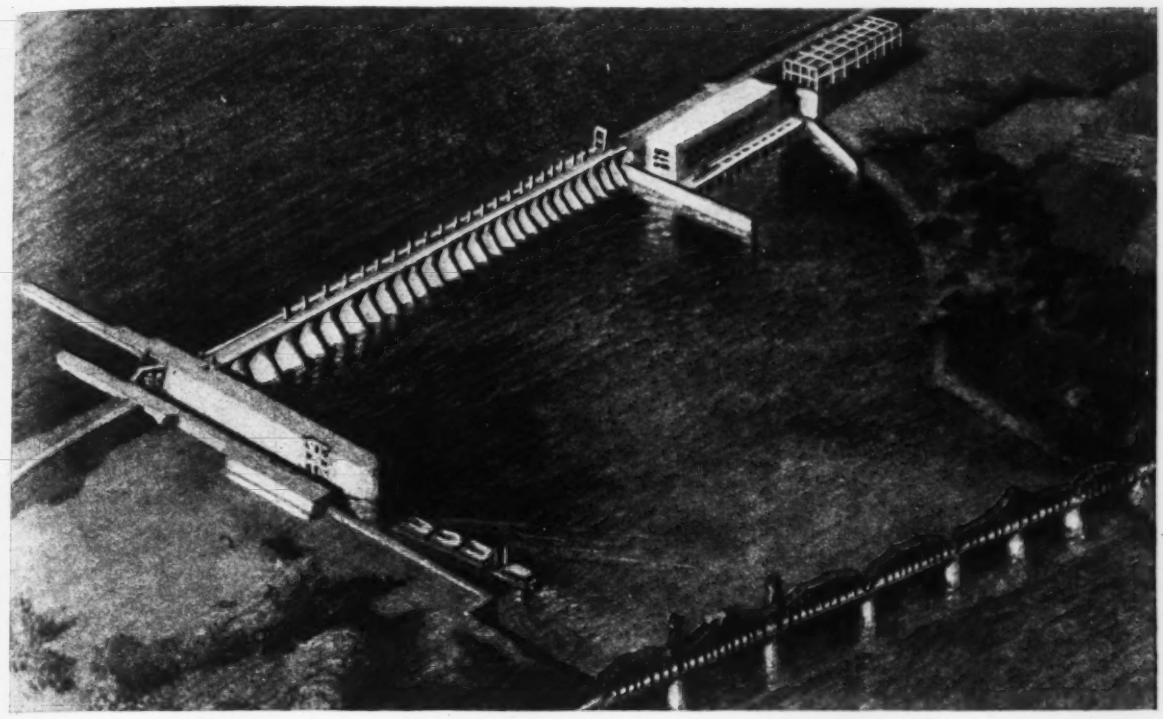


FIG. 1. PROPOSED GILBERTSVILLE DAM IN THE TENNESSEE RIVER, PART OF A RESERVOIR FLOOD CONTROL PLAN

Flood Control by Reservoirs

by ARTHUR E. MORGAN
Chairman, Tennessee Valley Authority

Reservoirs in the lower Tennessee and Ohio Valleys are proposed as a further step in the ultimate flood protection for the Lower Mississippi

THE FLOOD of January-February 1937 along the Ohio River and along the Mississippi River below Cairo has again brought into prominence the question of how ultimate flood protection for the lower Mississippi Valley may best be accomplished. New problems of flood protection for the Ohio Valley itself also have been introduced.

Following the disastrous flood of 1927 on the lower Mississippi, the Corps of Engineers, U. S. Army, adopted the Jadwin Plan of 1928 as the best means of affording flood protection to that region. This plan is based on an enlarged levee system with relief floodways at critical locations, designed to come into operation during maximum floods. In the reach from Cairo to below Helena, Ark., where the 1937 flood exceeded past flood records, this plan was constructed with some minor modifications and was in operation during that flood.

Jadwin plan inadequate

The 1928 plan was intended to provide for carrying 2,250,000 cu. ft. per sec. immediately below Cairo, with one foot freeboard on the levees, and with the 131,500-acre Bird's Point-New Madrid floodway on the right bank of the Mississippi south of Cairo in operation. The measured discharge for the 1937 flood below Cairo was 2,000,000 cu. ft. per sec., and *the actual flood heights which were reached show that the system will not safely carry the design quantity of water.*

At Cairo, for example, the water went about 6 in. above the top of the concrete wall at the upper end of the city, and was kept out of the city only by emergency wooden bulkheading. At Mounds and Mound City, Ill., the levees were overtopped. At Hickman, Ky., the water came to within about 3 in. of the top of the concrete wall. Below Hickman on the left bank the water reached to within a few inches of the top of the levees protecting the rich Reelfoot Lake country, and was held back by mudbox protection.

The 1937 flood reached record heights from Cairo to below Helena,

but farther downstream was not so high as the 1927 flood, because, during last winter's crest period, the White, Arkansas, and other lower tributaries were not contributing sufficient water to approach the 1927 volume. Furthermore, even in the reach from Cairo to below Helena the 1937 flood cannot be considered as the greatest possible. The discharge was largely from the Ohio River.

Measurements of discharge by the United States Geological Survey and by the United States Engineers indicate that of the 2,000,000 cu. ft. per sec. flow below Cairo 1,800,000 cu. ft. per sec., or 90 per cent of the total flow, was coming out of the Ohio. Had the upper Mississippi and the Missouri Rivers been contributing even a moderate flood discharge, the combined flow below Cairo would have been considerably greater. Undoubtedly Cairo and Hickman would have been flooded, levees in Kentucky would have failed, and the levees on the west bank of the Mississippi would have broken in critical places.

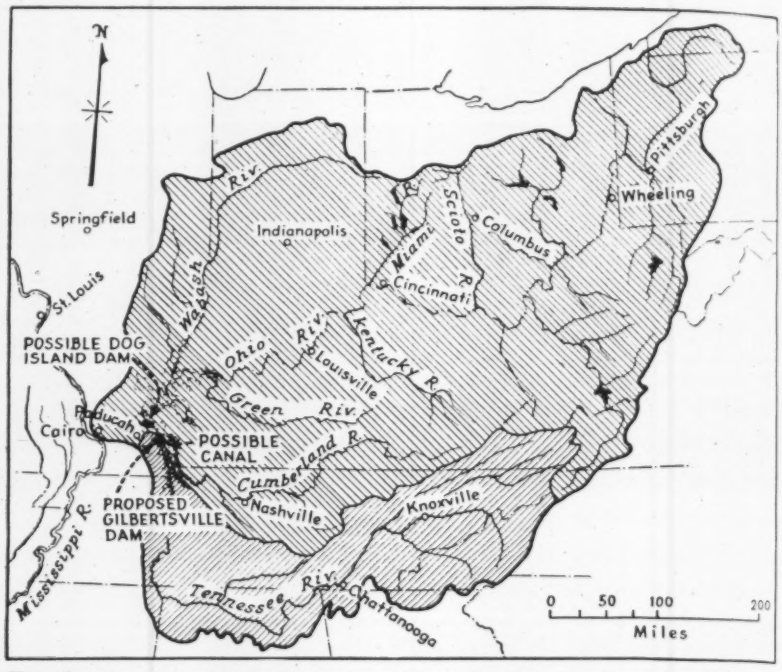


Fig. 2. The Ohio Valley, showing area affected by the reservoir plan. Hatching differentiates between Tennessee and Ohio-Cumberland watersheds.

More protection necessary

It is evident that the levee-and-floodway protection for the Mississippi Valley from Cairo, Illinois, to below Helena, Arkansas, was tested to the practical limits of its capacity by the 1937 flood, even though the volume of flow did not reach the maximum which sound engineering judgment indicates is possible. This means that more protection must be obtained. How may it best be secured?

Levees alone are not enough. The levees built according to the Jadwin Plan of 1928 are so massive in dimensions as to be in effect earth dams, and during the recent flood they undoubtedly engendered a feeling of security against failure on the part of the people behind the levees. But on account of foundation difficulties, seepage, wave wash, and kindred problems, it does not appear feasible to increase the height of the levee system throughout its length sufficiently to provide protection against maximum floods.

At the symposium on Flood Control of the American Society of Civil Engineers at Columbus, Ohio, in the Fall of 1927 I said, "In a great problem like that of the control of the Mississippi it would be almost miraculous if 100 per cent of the desired results could be achieved by only one method. The real problem is to discover and appraise all possibilities, and then, by careful analysis and synthesis, to design a total improvement in which each method is introduced to whatever degree is most effective and economical. If even ten per cent of the desirable results can be secured by each of two or three other methods, then control by levees may be reduced to far more manageable limits." Levees will continue to be a necessary and dominant part of the complete works required for ultimate maximum protection, but they should not be relied upon to do the job alone. They should have help.

Why reservoirs?

The most promising help available is reservoir control. In combination with other flood control methods, it should be provided to such an extent that the total result will represent the optimum combination to insure the greatest economy and efficiency, with full security to the protected areas. The combination of reservoirs and levees, with the help of spillways and revetments and occasional other methods, appears to offer the best solution to the problem of affording adequate and necessary protection to the lower Mississippi Valley with definite assurance against failure of the system.

Granting that, next to levees, reservoirs will have an important, probably a controlling role, in affording flood protection to the lower Mississippi Valley, where should such reservoirs be located? Much has been said in recent months about "upstream engineering," the advocates of which would control our streams by reservoirs on the upper headwaters. The futility of this method for controlling maximum floods is evident to any one who studies the 1937 flood and the distribution of the rainfall which caused it.

The axis of heavy precipitation falls on a line just south of the Ohio River, and the intensity decreases with distance back from this axis. There was intense rainfall over the lower and middle reaches of the Ohio River tributaries, with relatively light rainfall on the headwaters. The rain over the lower Cumberland and lower Tennessee River basins was very heavy, but on the upper reaches of both streams the intensity was much less. This shows that the problem cannot be entirely solved, certainly insofar as the Mississippi Valley is concerned, by reservoirs on the headwaters of the Ohio River tributaries.

Effective reservoir flood control for the Mississippi Valley should include

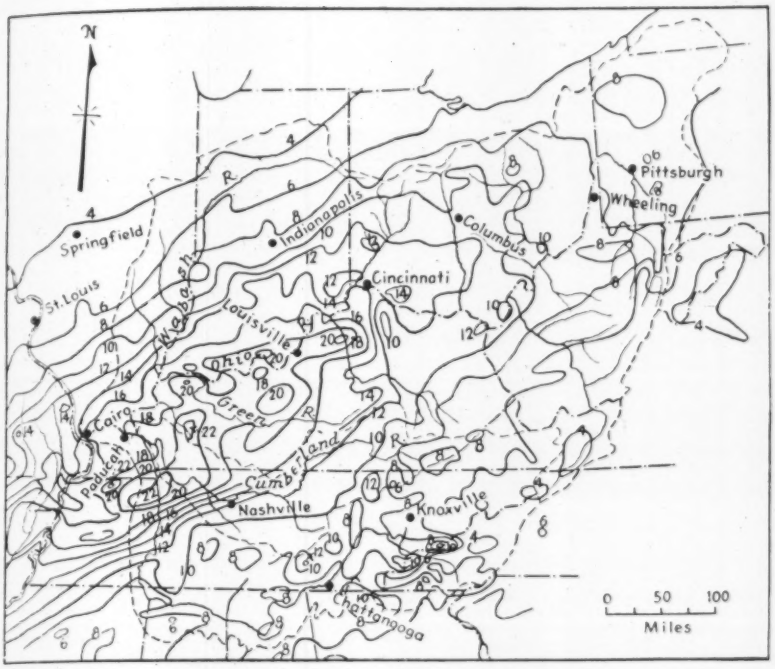


Fig. 3. Twenty-day rainfall and flood in the Ohio Valley last January, when more than 20 in. of rain fell.

reservoirs located on the Ohio itself and its principal tributaries as far down on each stream as possible. The reservoirs must be close to the area to be protected so as to be able to intercept and regulate the runoff from all parts of the drainage area above without leaving large areas uncontrolled.

In my paper read at the flood control symposium at Columbus in 1927 I said, "In case there should be opportunities for Mississippi flood control by means of reservoirs, where might the sites be found? In the writer's opinion they most probably would occur just above the mouths of the main tributaries, such as the Yazoo, the Red, and the Arkansas Rivers, where present backwater conditions probably should be continued, and on these main tributaries and their branches, probably not more than 200 or 300 miles from the Mississippi. The greatest benefit would be expected from a few large projects, rather than from many small ones."

"The writer believes that there may be opportunity for very considerable storage, amounting to many millions of acre-feet, on the Lower Ohio itself, and near the outlets of its main tributaries, as well as nearer the headwaters. If properly designed with low-water outlets, high dams could be built without undue hindrance to navigation."

The Tennessee Valley Authority has made a preliminary study and investigation of possible flood control on the Ohio River near Paducah. This study was made in the process of determining the feasibility and appropriateness of the proposed Gilbertsville Project on the Tennessee River, 23 miles above its junction with the Ohio River. The development by the Authority of the Tennessee River alone will require a dam on the Tennessee River in the vicinity of Gilbertsville; but if a dam were to be built on the Ohio River near Paducah the Gilbertsville Dam would not be necessary, for the Ohio Dam would back water up the Tennessee and create a navigation pool, eliminating the need for the dam on the lower Tennessee River. It was as a precaution against overlooking any possible alternative better than the Gilbertsville Dam that the Authority investigated the possibility of such a dam on the Ohio.

Two projects found promising

An extensive program of foundation exploration has been carried out including core drilling, digging test pits, and geological investigations. These explorations have covered possible dam sites along the lower Tennessee River and along the Ohio adjacent to the mouth of the Tennessee. They have developed the fact that two major projects are worthy of consideration, either one of which would furnish a method for controlling the combined flow of the Tennessee, Cumberland, and Ohio Rivers with substantial benefits for both flood control and navigation. (The Tennessee and Cumberland Rivers flow roughly parallel to each other, in one place less than two miles apart, and empty into the Ohio River only a few miles apart. The mouth of the Tennessee is just above Paducah, while the mouth of the Cumberland is about thirteen miles upstream at Dog Island.)

One project consists of a dam on the Tennessee River at Gilbertsville and a dam across the Ohio and Cumberland Rivers at Dog Island with a short, interconnecting, navigation and equalizing canal between the Tennessee and Cumberland Rivers joining the Tennessee, Cumberland, and Ohio into a common reservoir pool. The second project consists of a single large dam across both the Tennessee and Ohio Rivers at the mouth of the Tennessee just above Paducah.

Two-dam project best

A comparison of these alternative projects, based on the investigations and studies thus far completed, indicates that the two-dam project is preferable to the single dam at Paducah. Foundation conditions for the Paducah dam are inferior to those at the Gilbertsville and Dog Island sites, which makes the Paducah project the more expensive and less desirable. Not only is the two-dam project the less expensive and the less difficult, but it also lends itself readily to development in two steps, since the Gilbertsville Dam can be built as the first unit, to be followed at some later time, when desired, by the building of the Dog Island Dam on the Ohio River and the connecting canal from the Tennessee to the Cumberland River. Under this plan the nine-foot navigation project in the Tennessee River may be completed now, with the complete assurance that the Gilbertsville Dam is desirable whether or not a dam is later built on the Ohio.

Both Gilbertsville and Dog Island Dam sites are in the pool above the low navigation dam (No. 52) in the Ohio River below Paducah. The Gilbertsville Dam site is 23 mi. upstream

from Paducah on the Tennessee, the Dog Island site 13 mi. upstream from Paducah on the Ohio.

The two-dam project eliminates six existing low navigation dams in the lower Ohio River, five navigation dams in the Cumberland River, and four proposed navigation dams in the lower Tennessee River. It creates long stretches of clear channel, for about 215 mi. upstream on the Ohio River, for 184 mi. on the Tennessee River, for 150 mi. on the Cumberland River, and for about 50 mi. on the Wabash River. This is a total distance of 600 mi. of clear channel without a lock, with a minimum depth of about 14 ft., which is adequate for vessels of 9-ft. draft.

Huge storage obtainable

The area of the Gilbertsville reservoir at proposed normal pool level, about El. 357 above mean sea level, is 143,000 acres. At the surcharge level, El. 370, the area is about 232,000 acres and the flood storage 3,700,000 acre-feet. The area of the Ohio River reservoir above the Dog Island site, including the Cumberland and Wabash rivers, is 425,000 acres with normal pool level at El. 357. At the surcharge level, El. 370, the area is about 740,000 acres and the flood storage 9,000,000 acre-feet. The combined area of the Tennessee and Ohio River reservoirs at El. 370 is 970,000 acres, and their flood storage 12,700,000 acre-feet.

Such a large storage capacity located only 60 mi. above Cairo is sufficient to regulate floods from the entire Ohio River drainage area, and to reduce flood heights at Cairo enough to increase greatly the safety of the levee system in the reach from Cairo to below Helena. It is estimated that the crest height of the 1937 record flood would have been reduced in the reach between Paducah and Cairo about 4 ft. by the Gilbertsville-Dog Island reservoirs. The 1927 flood would have been reduced about 5 ft. and the 1913 flood about 5 ft. Many floods of moderate height would be almost entirely eliminated.

The design of the dam structures should be similar to the designs adopted for the main river dams now under construction on the Tennessee. The rock line at both the Gilbertsville and Dog Island sites is at an elevation sufficiently high to permit the founding of all the principal dam structures on sound rock.

After it was determined from the first explorations that the two-dam project was a feasible and logical one, more detailed studies for the Gilbertsville dam and reservoir were carried out. The cost of the Gilbertsville project is estimated at $112,000,000, including the dam itself, the navigation lock, the reservoir, land, clearing, highway and railroad adjustments, the powerhouse, power generating equipment, and other costs.

Dog Island project has not been studied as thoroughly as Gilbertsville, so that it is not possible to estimate the cost as closely. Sufficient investigations have been made, however, to indicate that the cost of the Dog Island project would exceed $325,000,000. The construction of such a reservoir would necessitate considerable readjustments in the surrounding area. Only as the result of a careful economic study would it be possible to determine whether the substantial benefits created are large enough to justify the adverse effects to agriculture, mining industries, towns, railroads, and highways.

It is estimated that 40 to 50 per cent of the area to be inundated is agricultural land. The fertile river bottoms would be put out of production. The flooding of this land would necessitate the relocation of the farm population accustomed to single-crop farming and would impose hardships on the tenant farmers, since it is unlikely that they could be easily absorbed in the surrounding area. A similar problem would, of course, be encountered in any plan of flood control based on large storage reservoirs.

The economical surcharge level of the Dog Island Reservoir will be determined largely by the amount of damage to the fluorspar mines and coal lands and coal mines of the Southern Illinois and Western Kentucky coal fields that border on the proposed reservoir.

These problems and certain operating problems must be studied intensively before a final appraisal can be made of the possibilities of the Dog Island site.

Benefits of the project

The chief benefits will be to flood control, navigation and power development, with recreation, fisheries and water fowl hunting as secondary but important valuable uses. The reduction in extremes of temperature along shore lines and on peninsulas in the

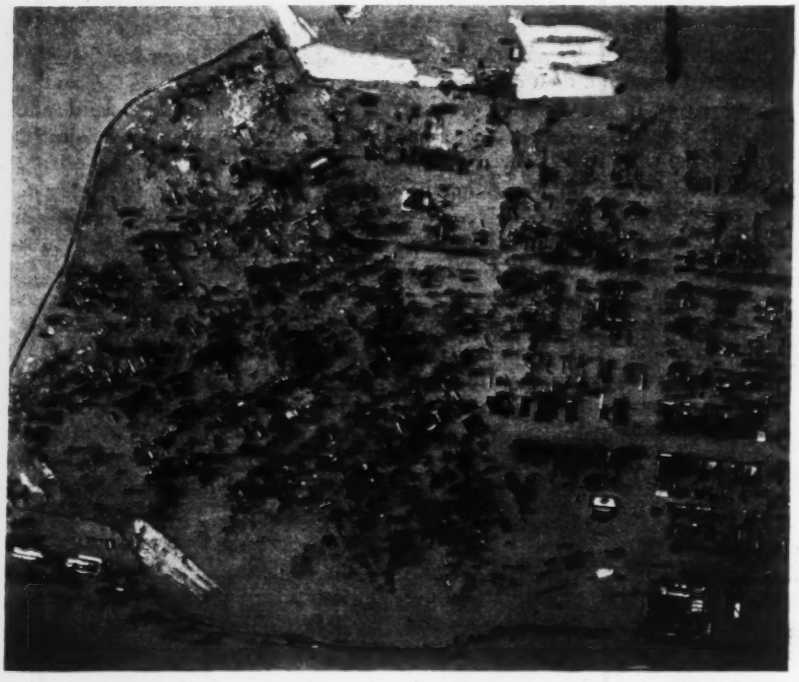


Fig. 4. Mound City, Ill., and many other river communities were inundated by the flood of last January, result of the abnormal storm charted in Fig. 3.

reservoir would reduce late spring and early fall frosts. Fruit raising and certain other intensive forms of agriculture would thus be greatly benefited. Those parts of the reservoir lands which would be covered only during floods could be farmed just as Ohio River bottom lands and the Miami River reservoir lands are cultivated today. Added fertility from silt deposits would make these lands very rich.

Houses and other farm buildings would be removed from the areas flooded. Along the upper reaches of the reservoir the overflow conditions of the river bottom lands would be but little different than they are today, except there would be no swift currents and the water would remain on the land somewhat longer. Loss of tillable land would be far less than is indicated by the large acreage of maximum overflow.

Flood control benefits will extend throughout the greater part of the lower Mississippi Valley. Flood heights will be so reduced that great floods, even such as exceed in magnitude that of 1937, will not cause concern to those living behind the present levees. The maximum probable flood below Cairo will be reduced so that it can be safely discharged between the levees. A justifiable sense of security will come to the lower Mississippi Valley and substantial landowners will no longer feel the need of keeping launches or boats in their backyards to take their families to safety in case of a levee failure. This increased security will permit the resources of the Mississippi Valley to be developed to a degree far beyond that heretofore practicable under the constant hazard of a possible occasional overflow.

Floodways would be safe

The Bird's Point-New Madrid floodway on the right bank of the Mississippi below Cairo contains 130,000 acres of land, much of it among the best land in the country. Flood easements have been purchased on these lands to permit overflow by flood waters whenever Cairo gage reaches 55. The landowners retain their lands and live on them to cultivate them, since the overflow belt is too wide to justify living outside.

During the 1937 flood this area was forced to be evacuated, under the most severe weather conditions of below-freezing temperatures, and under great hardships due to lack of roads and communications. With effective reservoir control on the Ohio, it would be necessary to overflow these lands only at very long intervals, and perhaps not at all. It is probable that sufficient reservoir control can be accomplished by the Dog Island and other projects so that this fine body of land may be permanently reclaimed and returned to profitable cultivation without being under the continual menace of overflow.

Railroads and highways in the region of Cairo were overflowed and traffic was disrupted by the 1937 flood. Adjustment of these to maximum flood conditions would be costly and can largely be rendered unnecessary.

Lands not now protected by levees would be benefited by elimination of overflows or reduction of frequency. Flood heights would be greatly reduced and adequate levee protection could then be provided at a reasonable cost. Thousands of acres of fertile, sandy loam lands between the present levees and the river would benefit materially by decreasing the frequency of overflow.

The extent of backwater areas above the mouths of tributary streams would be reduced by the lower flood heights. This would benefit particularly the lands on the Arkansas side along the mouth of the St. Francis River just above Helena and along the mouth of the White River south of Helena.

Protection for the cities

For the towns along the river, Cairo, Hickman, Caruthersville, New Madrid, Mounds, Mound City, Osce-

Fig. 5. Ohio River drainage would be controlled almost completely by the Dog Island-Gilbertsville reservoir. Ohio River dam 52 is shown.

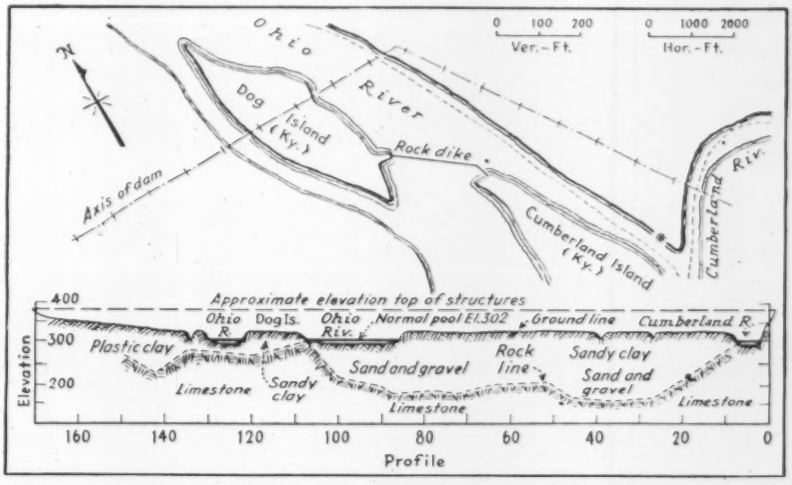


Fig. 6. Foundation conditions at Dog Island as explored by borings to rock are much better than near Paducah, 10 or 12 miles downstream.

ola, Luxora, Wilson—and also those back from the river but protected by the levees, the present protection by earth levees and concrete walls should be ample against future floods, after reservoir control of the Ohio is accomplished.

Paducah was seriously flooded by the 1937 high water to a depth greater than the probable possible reduction of flood heights by reservoir control at Dog Island alone. However, such control would reduce the height of the necessary levee wall to protect the town.

The city of Memphis is proposing a project estimated to cost $12,000,000 or more to protect the northern and southern parts of the city against a flood 5 ft. higher than 1937. The necessity for this expenditure would be largely removed by reduction of flood heights through reservoir control.

The annual cost of levee maintenance and high-water fights would be much reduced. As a matter of fact, high-water fights as we now know them would be practically eliminated. With lower flood crests, there would be less seepage and fewer boils behind the levees, less damage from wave wash, less sloughing of slopes, less foundation troubles and subsidence. There would seldom if ever be need for mobilizing large labor forces to build up the levees by emergency measures as was the case in 1937. Moderate patrolling of levees with proper attention to boils and wave wash would still be required, but this would be largely a routine matter. Pumping costs during floods at such places as Cairo would be lessened due to reduction in heads.

Part of a reservoir system

The Dog Island-Gilbertsville Project would be of direct benefit for flood control to the Mississippi Valley but not to the Ohio River Valley, excepting to that portion from Paducah to its mouth. The project benefits navigation on the Ohio, Cumberland, and Tennessee Rivers. By regulation, low water flows will be increased and thereby benefit navigation on the lower Mississippi with a probable decrease in the present dredging costs for channel maintenance.

The effect of the Dog Island Project on Mississippi River flood control should not be considered by itself, but in relation to other reservoir projects which are under construction or being planned. The Tennessee Valley Authority is building a system of reservoirs on the Tennessee River and its tributaries which, when completed, will play an important part in Mississippi River flood reduction. In 1937, with Norris Dam storing 1,250,000 acre-feet during January, practically the entire flow of Clinch River from the 3,000 sq. mi. above the dam was stored, and with Wheeler Reservoir regulating flow on the main Tennessee the crest at Cairo was reduced several inches. If the other main Tennessee river and tributary reservoirs had been completed and in operation, the reduction would have been considerably more.

Proper operation needed

Reservoirs are proposed for the Cumberland River and for other Ohio River tributaries. Tygart Dam is nearing completion on the Tygart River upstream from Pittsburgh. These reservoirs will form parts of the complete system of control. In such a system, Dog Island reservoir has the strategic advantage of large storage capacity so located as to do the maximum good for flood control on the Mississippi. It is possible that one or two other large reservoirs on the Ohio itself would contribute greatly to the protection of Cincinnati, Louisville and other cities on that stream, with further added factors of safety on the Ohio and the Mississippi.

Too much emphasis cannot be placed upon the need for proper operation of the reservoir system in floods. An entirely adequate system of flood control reservoirs may fail to accomplish the purpose for which intended if the human element breaks down. An inadequate system or an isolated reservoir suitable only for limited peak reductions requires considerable skill and judgment in operation if satisfactory results are to be obtained. The difficulties connected with the operation of the Gilbertsville-Dog Island Reservoir for flood control may be visualized by going back just a few months to the great Ohio-Lower Mississippi flood.

The river rose steadily at Cairo for about one month before reaching on Jan. 24 the highest stage previously recorded (56.4, in 1927). It continued to rise for 10 days, reaching a peak of 59.6 on Feb. 3 and 4. On the recession it reached a stage of 56.1 on Feb. 11, thus remaining above the highest previous stage of record for about 19 days. Recurring storms in the latter part of January and early February added new impetus to the rising flood from time to time, just when it seemed that the peak of the high water was near.

Thus, the crest at Cairo came anywhere from 4 to 10 days later than expected, actually 4 days later than first tentatively forecast by the U. S. Weather Bureau on Jan. 25, and held within a relatively narrow range for about 20 days. The significance of this is that long before the crest occurred Paducah was flooded, Cairo was threatened and the general situation was serious. The urge would have been to store the water long in advance of the peak to save the situation, and this might have resulted in an ineffective reservoir operation. This particular situation emphasizes not only the need for competent hydraulic engineers but even more the absolute necessity for placing the responsibility and authority for reservoir operation in one person whose decisions shall be final. Absolute integrity of operation, free from all political influences and from a desire to store water primarily for power generation, would be essential for the avoidance of disaster.

Restudy the flood problem

Again reverting to my 1927 Columbus address, I expressed the opinion that ". . . from time to time the problem of flood control on the Mississippi should be examined *de novo*, as if nothing were known about it, to discover how the new scale of thinking will affect the plans. The writer believes this to be desirable, regardless of the skill and standing of the men who have made previous studies, because the state of professional knowledge and the issues to be met change so greatly that old decisions cease to be authoritative. Dams on the Ohio have been dismissed as involving too many complications. The difficulties that formerly seemed insurmountable may now be only necessary incidents of the best plan."

This statement of ten years ago is as applicable today as when it was first made. The 1937 flood points clearly to the desirability of such a re-examination of flood problems.

Effective Waterworks Organization

by E. Grosvenor Plowman
Denver, Colorado

The first step toward strong and efficient management is the abandonment of the apron-string relationship between the regulatory branch of the city government and the water utility

The weaknesses of the typical water utility organization in the average American city are largely due to a dispersion of functions, to closely defined legal requirements and to attemps to cater to the whims of an uninformed public. These were outlined in detail in a previous article (*ENR*, Aug. 5, p. 225). The present discussion is concerned with the importance of sound basic organization as related to efficient management.

City charters have tended to scatter the water utility among existing city departments, presumably because of the belief that thereby operating economies are obtainable. Unfortunately dissimilarity of activity between ordinary city departments and the water utility is too great to bring about the desired results. Confusion and managerial inefficiency grows out of such division of the natural water utility operating unit.

Charter and ordinance draftsmen have used precise legal language to define the functional activities of the water utility. Thus conformance to the letter of the law becomes the accepted operating procedure. Inefficient or roundabout operating practices are maintained merely because they are legal. Much duplication develops where there is legal overfunctionalization.

Responsibility to public opinion rather than to a board of owner-directors has led to many imposed requirements and concessions of costly and inefficient character, such for example as prohibition of metering.

Organization weaknesses

Much talk and little accomplishment is the lot of the reformer who aims to correct municipal mismanagement through personnel improvement. By and large municipal water utility executives personally are competent. Most of their alleged incompetence is due to organization weaknesses which are beyond their control.

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To improve municipal water utility organization we must get at the root of organization weaknesses, namely, the apron-string relationship between the regulatory branch of the city government and the water utility.

To improve municipal water utility organization we must get at the root of organization weakness, namely, the apron-string relationship between the regulatory branch of the city government and the water utility. To put the matter bluntly—as long as Johnny, the water department, must run to mother, the mayor and city council, with his cuts and bruises, he will never be the upstanding, complete man we desire; and as long as mother takes Johnny's pay envelope (the water utility income) and doles out his spending money, he will never be able to take care of himself.

Water department executives are well aware of this apron-string restriction and talk privately of the advantages of the independent water board. While they have been talking school teachers have been acting. Everyone knows that the typical American school system is today operated under an independent board, divorced from the city government. This divorce was approved by municipal voters to eliminate the same organization weakness which is now the curse of the typical water department. School boards came into being despite the resistance of the same group that today opposes integrated and independent water utility operation, namely, the city government politicians. The latter have a natural and understandable reluctance to abandon a responsibility which would thus lead to less personal prestige.

Independent water boards

As long ago as 1852 this great fundamental of good organization—independent status—was well understood. Detroit, for example, bought its private water system in 1837 and placed its management in the hands of the city council. Fifteen years later the mounting deficit caused by unrelated borrowing and income resulted in an investigation. As a result, in 1852, Detroit's water utility was turned over to an independent water board, created under state law. In 1918, after 66 years of careful management, this board gave way to a semi-independent water board appointed by the mayor. This latter board is proving itself a progressive and worthy successor.

There are too many factors involving personal judgment to permit of an exact proof that such a water utility is better organized and therefore better managed than any other. This writer, after some consideration, nominates the properties at Erie, Pa., and the water utility operating in and around Oakland, Calif., as deserving

high or highest honors in management efficiency.

The Erie water utility was established in 1867 under a special state law creating an independent board of water commissioners appointed by the county court. For 70 years this medium-sized municipal water utility has scarcely known the meaning of the word "politics." As of Dec. 31, 1933, the Erie water utility had collected during its whole existence $15,010,760. Nearly two-thirds of this sum was still represented by undepreciated plant values, after subtracting a small and recent bond issue. The plant is modern and up-to-date. It has two separate intakes capable of withdrawing from deep water of the lake five times as much as the present daily consumption. All water is filtered. Ninety per cent of the city pipe system is 6-in. or larger in size. Cost of coal for pumping a million gallons of water was $8.43 in 1919 but by 1933 this had been reduced to $3.94.

A record of service

Back of this excellent record is a strong and experienced management, made possible by a good organization structure. The three water commissioners are appointed by the county court for three-year terms. From 1867 to 1933, a 67-yr. period, the average commissioner served his city for two terms. One served 15 years, another 12, and six for 9 years each. Only three members have resigned in office. No unpaid member of the board has ever resigned to accept a salaried position in the water department. One of the board's salaried chief executives, recently deceased, held his top managerial position for 27 years. He served the Erie Water Board as a faithful employee for a total of 52 years, a remarkable record.

Minor weaknesses in this excellent situation are due to remnants of the common apron strings leading to the city government. The city government has never paid any water charges, apparently resting its case on assumption of early bond issues, long since paid off. The city government has veto power over rate changes. Probably because of this Erie remains for the most part unmetered, using a complex structure of flat rates developed 40 years ago.

The East Bay Municipal Utility District, operating the water utility for Oakland, Berkeley and neighboring communities, is barely 10 years old. Its efficient record to date indicates the soundness of its organization plan, developed by a mayor's committee representing all interested communities.

The district is practically a municipal government, having the power to tax, to issue bonds within its debt limit, to annex territory and to buy or engage in other utility activities, all according to the vote of its elected board of five directors, and subject to the approval of the voters at the polls. It has no powers or duties of municipal government character, except in connection with its proprietary operations.

The district may also be thought of as a public corporation, or authority, as now often called. It has every power needed for its work, including the all-important power to plan and inform the public about its plans. It is completely integrated, operating its own civil service and having its own engineers and attorneys. It can sue and be sued. All relations with city governments are businesslike and commonsense.

The East Bay Municipal Utility District within 4 years after its creation had purchased the private water utility and brought in the long-needed supply of mountain water from the Sierras. Construction work was accomplished within its estimates and ahead of schedule.

The district has improved the quality and pressure of its water service. All pumping has been electrified. Purchases are made according to rigid specifications, and quality is maintained by constant testing. Insurance costs, especially for industrial accidents, have been drastically reduced. Insurance premiums are distributed, by means of a novel pool, to all responsible resident agents.

Well-managed utilities

There are other well-managed municipal water utilities. To mention a few: those serving San Francisco, Los Angeles, San Antonio, Denver, Omaha, Des Moines, Louisville, Detroit, Washington (Maryland suburban district), and metropolitan Boston, where efficient management is powerfully backed by a more or less independent water board organization. Good management also exists in such cities as Milwaukee, Cincinnati, El Paso and Baltimore where outstanding water utility executives have been given unusual support despite organization handicaps.

Clothes do not make the man, nor does sound organization insure efficient management. But sound basic organization is the necessary first step toward permanent and efficient management.

The concluding article by Mr. Plowman, outlining suggestions for improving waterworks management, will be published next week.

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Zoning Revision Planned In Many Cities

CITIES in various parts of the country are showing considerable interest in revision of zoning ordinances, the American Society of Planning Officials reports. In the East, several planning organizations meeting recently at Harvard University discussed revision or modernization of the municipal zoning laws of New England, while Portland, Ore., which has amended its zoning ordinance, furnishes an example of the interest of far western cities in the subject.

Portland, Ore., in looking over an ordinance suspected of being at the root of some municipal troubles, found more than 50 per cent of all area zoned in the city earmarked for apartments and duplexes in a city which prides itself on its homes. The zoning ordinance has been amended to provide more space for single-family residences and less for multiple-family dwellings and business, both of which have been allocated space out of all proportion to their present and potential needs. Stratford, Conn.; Providence, R. I.; Lansing, Mich., Milwaukee, Los Angeles and New York are other cities which have expressed concern recently over certain deficiencies in their zoning ordinances and have recommended that revisions be made. Milwaukee and Racine, Wis. now prevent the erection of residences in manufacturing districts; Los Angeles requires apartment buildings to provide off-street parking space for tenants "on the lot;" Riverside, Ill. requires movie operators to provide off-the-street parking for patrons at the rate of 200 sq.ft. to each six seats.

Bridgeport Profits by Incineration Which Replaced Reduction

Garbage disposal cost reduced by $18,000 and former odor nuisance eliminated

ABANDONMENT of a steam reduction plant in favor of incineration for garbage disposal in Bridgeport, Conn., has resulted in a saving of more than $18,000 during the first year of operation, according to Frederick E. Toquet, city engineer. The new incinerator, which is a three-cell hand charged furnace of the mutual assistance type, has a capacity of 150 tons per 24 hours and was built at a cost of $110,000.

Unit operating costs for incineration average $1.39 per ton as against $3.30 per ton in the reduction plant. Additional savings to the municipality also accrued from the lessened demand for fire apparatus which was required to extinguish fires on rubbish dumps where formerly all the combustible wastes were deposited. These combustibles are now, for the greater part, burned in the incinerator and no fuel needs to be purchased for disposal.

Abandoned plant

The old steam reduction plant, which the incinerator replaced, was of the so-called Arnold type, in which garbage and offal were cooked by direct application of steam at pressures of between 100 and 125 lb. Condensing apparatus was installed in 1931, eliminating the odor nuisance which had emanated from the exhaust system for several years and which was the cause of many complaints. Failure to keep this condensing system in condition, however, resulted in a return of the nuisance within a few months after it was placed in commission. In the meantime the price of the products, grease and fertilizer tankage, dropped 60 per cent, thus creating a situation in which restoration of the plant, at an estimated cost of $125,000, was considered economically unsound.

The new incinerator is equipped with two complete combustion units discharging into a single chimney. Each unit consists of a three-cell furnace, a combustion chamber at right angles to the furnace, and an air tube preheater parallel to and behind the furnace. The furnace cells are not separated but each is provided with an individual stoking door at grate level and an ash cleanout door at floor level. The arrangement is in series, the last cell discharging gases over a bridge wall into the side and near one end of the combustion chamber, which in turn discharges into the end of a preheater of the same size near the other end of the chamber.

Flues from the respective preheaters join the central or main flue leading to the chimney. The path of the products of combustion makes four right-angle turns before reaching the chimney, besides encountering a vertical baffling at the bridge wall and again at the curtain wall located at the exit from the combustion chamber. This insures good mixing of hot gases with solid particles and causes the deposition of fly ash at points convenient for its removal.

The incinerator is being operated 11 hours daily, burning an average for the year of 64 tons of waste per day. The maximum month of operation was last August, when 2,127 tons of combined garbage and rubbish were burned at an average rate of 82 tons per working day.

Six-man commission

The Bridgeport incinerator was built under the direction of a six-man commission appointed by the city administration and approved by the Connecticut state legislature; Frederick E. Toquet, city engineer, was secretary of this commission. The principal contractor on this work was the Hiler Engineering & Construction Co., Inc., of New York.

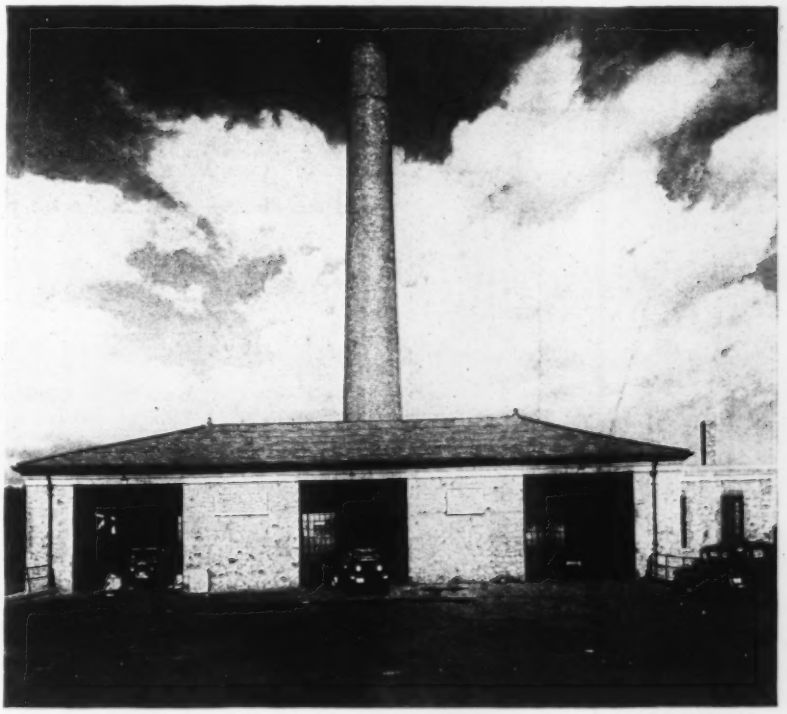

Fig. 1. Incinerator at Bridgeport, Conn., which has a capacity of 150 tons per 24 hours. From the charging floor level shown above the refuse is dropped into furnaces of which there are two units, each of three cells.

Retaining Wall Design

by E. A. MENUEZ
University of Toledo, Toledo, Ohio.

Formulas are derived from which base width of gravity retaining walls may be obtained by substitution

MOST of the theories of lateral earth pressure used in retaining wall design assume a hydrostatic pressure distribution with a value $P = K\frac{wh^2}{2}$, in which h is the height of the wall, w is the unit weight of the earth, and K is an arbitrary constant.

Recent research indicates that the line of action of the earth thrust is inclined at some angle ϕ to the normal to the back of the wall, ϕ being sensibly equal to the angle of internal friction of the earth. The use of the inclined thrust gives a more economical section but many designers prefer the use of a horizontal thrust as an additional safety factor, and the Institution of Structural Engineers (London) recommends that this inclination be taken as 1/2 to 2/3 of the angle of internal friction.

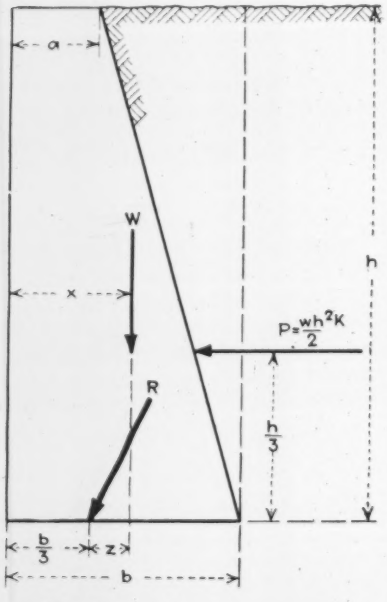

Fig. 1. Earth thrust horizontal.

The formulas for wall sections which follow are applicable for use with any of the usual theories by inserting the proper constants, k, k_1, k_2, etc. In the design of a wall section by these formulas, first assume the top width of the wall a, then insert the proper constant and solve for the base width b.

Horizontal earth thrust

If the earth thrust is considered as horizontal, the forces acting on the wall are: the thrust, the weight of the masonry, and the weight of the earth lying over the base of the masonry (Fig. 1). Assuming that masonry weighs 150 lb. per cu.ft., and that earth weighs 100 lb. per cu.ft., the total gravity force acting on the wall per foot of length is, referring to the figure:

$$W = \frac{(5b + a)h}{40} \text{ kips}$$

and the distance x, from the toe to W, is:

$$x = \frac{7b^2 + ab + a^2}{3(5b + a)} \text{ ft.}$$

If z is the distance between the intersections of the resultant, R and W with the plane of the base, then from statics,

$$z : \frac{h}{3} :: P : W$$

$$\text{Now } P = \frac{Kwh^2}{2}.$$

Let k_0 equal 50 K, and we have $P = k_0h^2$. Then:

$$z = \frac{40k_0h^2}{3(5b + a)}$$

If there is to be no tension over the base, R must cut the base within the middle third. If R cuts the base at the outer edge of the middle third, we have:

$$x - z = \frac{b}{3} \text{ or}$$

$$\frac{7b^2 + ab + a^2}{3(5b + a)} - \frac{40k_0h^2}{3(5b + a)} = \frac{b}{3} \text{ and}$$

$$b = \sqrt{\frac{-a^2 + 40k_0h^2}{2}} \quad \ldots\ldots (1)$$

The end formula for the case when earth pressure is considered horizontal.

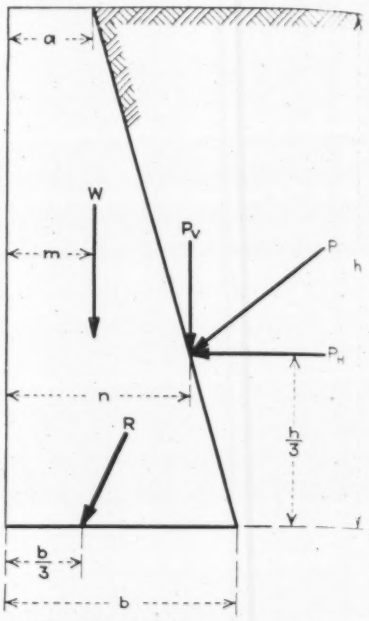

Fig. 2. Earth thrust inclined.

Inclined earth thrust

In the case of an inclined earth thrust it is convenient to consider the horizontal and vertical components of the thrust as $\frac{k_1wh^2}{2}$ and $\frac{k_2wh^2}{2}$ respectively, where $k_1 = k \cos \phi$ and $k_2 = k \sin \phi$ where ϕ is the angle of inclination of the thrust.

The forces acting on the wall are shown in Fig. 2.

If 100 lb., the unit weight of earth, is w and 150 lb., the unit weight of masonry is w',

$$W = \frac{(a + b)}{2}hw', \text{ or}$$

$$W = 3\frac{(a+b)}{4}hw$$

$$m = \frac{b^2 + ab + a^2}{3(a+b)}$$

$$n = \frac{2b+a}{3}$$

Then

$$m - \frac{b}{3} = \frac{a^2}{3(a+b)} \text{ and}$$

$$n - \frac{b}{3} = \frac{b+a}{3}$$

If R cuts the outer edge of the middle third at A

$\Sigma M_A = 0$, whence

$$\frac{3(a+b)hw}{4} \times \frac{a^2}{3(a+b)} + \frac{wh^2k_2}{2} \times \frac{(b+a)}{3} - \frac{wh^2k_1}{2} \times \frac{h}{3} = 0$$

Solving, we have

$$b = \frac{2k_1h^2 - 3a^2 - 2k_2ah}{2k_2h} \quad \ldots\ldots (2)$$

The formulas (1) and (2) thus give a means of obtaining by direct substitution the base width of the gravity retaining wall. It is only necessary to insert an assumed value of the top width, a, the known value of the height, h, and the assumed constants, k.

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Colored Concrete Center Curb

COLORED CONCRETE will be used for the center curb or island separating the two lines of traffic on the new dual highway from Indianapolis to Cumberland, Ind. Due to the impossibility of obtaining sufficient right-of-way to provide a parkway between the two 22-ft. traffic lanes, the state highway engineers designed a low curb or island to separate the two lanes. This island, 4 ft. wide at the base and 2 ft. wide on top, will rise 4 in. above the surface of the pavement. Three colors —white, yellow and natural—will be used on the sloping sides and black on the top of the island. Through use of the three colors, the engineers hope to determine which has the greatest visibility under all driving conditions. A number of tests, were conducted preliminary to selection of the three colors for actual use.

Asphalt-Bound Jetty Head Fails

Asphalt poured around large rock fragments in Columbia River jetty did not develop a bond strong enough to resist the winter's storms

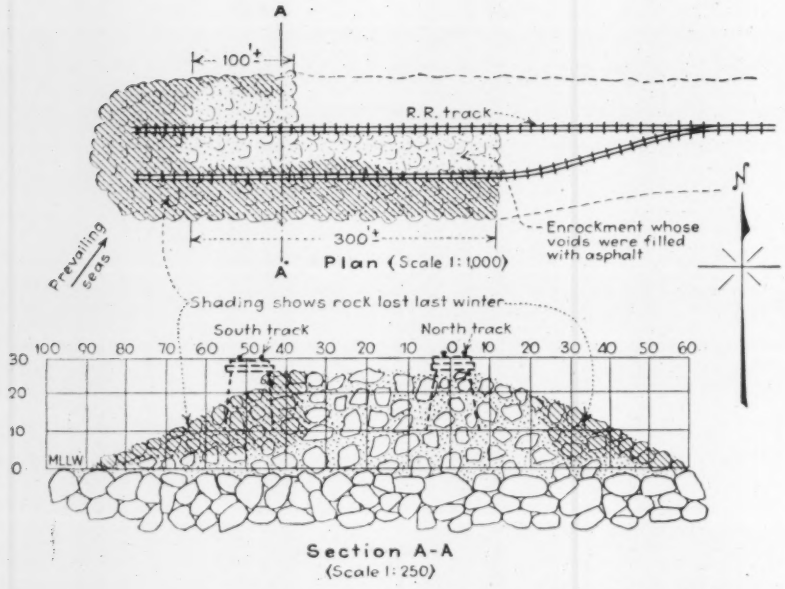
ASPHALT used as a binder for holding together large rock at the head of the south jetty where the Columbia River empties into the Pacific Ocean did not withstand the battering of last winter's storms. A large part of the 13,000 tons of asphalt placed hot during August and September last year as an experiment was swept away by rough seas of the stormy season. As a result, and because rocks of a size large enough to resist the force of the waves are too big to be handled by equipment on the jetty, designs are being prepared and studies are being made on heavy concrete monoliths better able to withstand the battering of waves. However, because asphalt binder may be useful where different requirements obtain, the conditions, methods of placing asphalt and results on the Columbia jetty work are outlined in the following.

There are two jetties at the mouth of the Columbia River; the one on the north, 2½ miles long, has the advantage of projecting into the ocean in the general direction of the prevailing winter winds, thus it is exposed more or less end on to the battering of the seas. The south jetty, on the other hand, had to be located where it would protect the channel entrance to the Columbia River from waves that sweep in from the southwest. This jetty, seven miles long, lies in such a position that the prevailing winter winds sweep across its outer end at an angle of about 45 deg. Wind velocities as high as 100 m.p.h. have been recorded here and with water depths of 40 ft. or more close to the jetty end, the terrific battering of the seas has been such that for many years piece-meal disintegration of the end of the structure has been going on. This breaking away of the jetty head has been accelerated as water depths near the jetty end have increased. However, indications are that if the raveling at the outer end could be stopped the remainder of the structure would stay in place and would perform its function.

South jetty construction

In the original construction of the head of the south jetty the intent of the designers was to meet the forces of the sea with heavy material on a gradual slope that would break up the waves before they reached the rock above water level. The largest rock that can be handled by equipment on the jetty is 25 tons. However, experience of the year has shown that stone of this weight on a 3:1 slope was not sufficient to prevent progressive destruction of the jetty by unraveling at its outer end. Two to three hundred feet of the heaviest stone that could be handled sometimes is swept off the end of the jetty above low water in a single winter. In an endeavor to combat this condition, decision was reached about a year ago to make an experiment in pouring a hot asphaltic matrix into the heavy enrockment at the outer end of the structure and thus to embed them so the combined weight of the mass could resist the force of the seas.

Construction of the south jetty was started in 1885 and completed in 1913. No maintenance work was done until 1932 by which time the battering of many winter storms had flattened the top of the enrockment to about low water level and changed the section so that the top width was about 200 ft. at low water mark. Retopping done in 1932-35 added an average of about 188 tons per lin. ft. to the weight of the enrockment. Of this additional material, 45 per cent was required to be in pieces



Plan and section of jetty head showing penetration of asphalt and portions washed out (indicated by cross hatching) by winter storms.

weighing not less than six tons with an average weight of 12 tons. Less than 20 per cent of the stone was to weigh less than one ton per piece. On the surfaces all small stone was placed in voids between the larger pieces.

Asphalt placement methods

The plan for using asphalt as a binder to unite stone in the outer end of the jetty into a unified, solid mass contemplated filling the voids with hot mastic and thus forming a truncated pyramid at the end of the jetty. A length of 320 ft. on the exposed side and a little less than half this length on the leeward side were impregnated with asphalt hot enough to permit of pouring it. This required about 13,000 tons of asphaltic mix. Examination after placement indicated that this had been poured in such a way that effective penetration had been obtained to an average level of 1 ft. above mean lower low water and that it effectively filled the voids between the stone.

This effective placement is ascribed to arrangements that were made in advance to insure prompt delivery of the material in order that placement could be made at the desired temperature. The asphalt used was a "D" grade of 50-60 penetration with a flash point above 500 deg. F. Experiment indicated that best results were obtained with an admixture of this material with sand, the asphalt content ranging from 15 to 18 per cent by weight. The richer mix gave more fluidity and some free asphalt which served as a lubricant and was thought to give a better bond with the rock. The leaner mix was used on the outer slope where fluidity was not essential.

The materials were prepared in a heating plant erected on the sands near the jetty about 3½ miles from its outer end. By putting the plant in this location a minimum of time would be lost in delivery. The sand was preheated and the mix left the plant at a temperature of about 450 deg. F., after sand and asphalt had been mixed for about one minute. From the mixing plant the material was hauled in 10-ton dump buckets, with three buckets (30 tons) to the car load. Under these conditions, temperature loss 4 in. in from the surface of the mix in the bucket was only 20 deg. F. during the 25 min. consumed in the trip from the plant to the point of placement. A locomotive crane was used for dumping the 10-ton buckets and by means of baffles as much of the mix as possible was forced into the interior of the jetty so that it would work from the inside toward the outer slope. In this way, it was believed that the most homogeneous mass possible would be secured.

One effect of the placement of such hot material against wet rock surfaces or where it would come in actual contact with the water, was that contact with the cold moisture changed the mastic to a frothy, porous emulsion which would not adhere to the rock, nor stick in the voids, and which was readily washed away by wave action. Although a relatively small percentage of the total tonnage placed was affected in this way, the zones where this condition obtained naturally were at the lowest levels and on the outer surfaces where even in the calmest weather there is some wave surge. The cost of making this asphalt emplacement totalled $87,500 for the 12,787 tons used, or $6.84 per ton of mix.

Effect of winter storms

Storms that buffet the south jetty are more severe than channel protection works ordinarily are required to withstand. At North Head, the nearby observation station, wind velocities sometimes reach 100 m.p.h. and there is a record of an 80-m.p.h. wind continuously for 6 hours. However, in the winter of 1936-37 storms were less severe than the 10-year average and storm wind velocities ranged from 30 to 60 m.p.h.

During construction of the jetty it has been learned that the voids between the rock amount to about one-third the total volume of the enrockment. This percentage of voids is based on measurement of rock as it left the quarry as compared with measurements after placement in the jetty. A further check which agreed with this percentage was found in the volume of asphalt mix required to completely fill the voids.

Asphalt placement was completed on Sept. 11, 1936. The first erosion was noted after the storm of Dec. 6, at a point about 100 ft. from the outer end of the jetty and between high and low water level. Under the battering of the usual January and February storms, the heavy rock imbedded in the asphalt on the leeward as well as the windward side of the jetty was carried away in quantities comparable to the rate of raveling prior to the placement of asphalt.

Although it is estimated that the present jetty head now contains sufficient material to last through one more winter, it is the general belief that ultimate flattening to low water level of the jetty head in which the

asphalt was poured is certain. In many places jetty rock and the asphalt binder have been undercut and the face is overhanging. Indications are that disintegration began, for the most part, near the water line of the jetty head. Inspection of the jetty head, after removal by storms to the part of the rock that had an asphalt matrix, indicated that the asphalt placement was as effective as could have been obtained with the material and methods used on the job.

Conclusions

The failure of the asphalt to bond with the rock is believed to be largely because the volume of the individual stones is so large that their temperature cannot be increased to a point that would make good bond possible. Further, the bond is weakened, particularly in the lower levels by the effect on the hot asphalt of water or even a film of moisture. Because of the high temperature, when the mix came in contact with water or even with moist surfaces of rock, steam was formed which fluffed up the mix into a porous, frothy material of very low strength not capable of forming a bond. When the work was being studied suggestion was made that possibly the mix might be placed at temperatures of 200 deg. F. or less so as to avoid generating steam. This was thought to be a possibility in forming a mastic to key the individual stones together, but it was not believed that a better bond would be secured nor that the objective of an integral mass could be obtained by that method.

No repairs to the outer end of the jetty are contemplated this year, but recommendation has been made that after another winter season a "more permanent terminal," probably of concrete, should be constructed. The work at the outer end of the jetty, where asphalt was used, affects only a very small part of the structure, and failure there does not materially impair the effectiveness of the jetty as a whole.

In the asphalt experiment the work was done on a day labor basis under the direction of Lt.-Col. Milo P. Fox, Corps of Engineers, district engineer, Portland, Ore. R. E. Hickson was principal civilian engineer in the district office. O. J. Hawkins, assistant engineer was resident on the job.

FIG. 1. THE SMALL TOWER MARKS THE SITE OF EDISON'S LABORATORY.

Edison Memorial Tower For Menlo Park

A concrete tower of interesting type is being built to mark the birthplace of the electric lamp

MENLO PARK is to be marked by an enduring memorial of Edison's greatest creative work, the development of the incandescent electric lamp. It will have the form of an octagonal reinforced concrete shaft or tower 118 ft. high, bearing at the top a huge lantern in the form of an incandescent lamp bulb. W. S. Barstow, one of Edison's friends and co-workers, is contributing the monument to his memory; it is to replace a temporary memorial lamp tower built for "Light's Golden Jubilee" in 1929 and since maintained in uninterrupted burning. The temporary tower is shown in Fig. 1.

Unique in construction as well as design, the tower will take advantage of the highest achievement of the concrete art. Its facing is of precast concrete slabs made by John J. Earley, with special colored aggregate chosen to produce the desired architectural effect. It was this possibility of controlling color in a permanent material that in fact was a principal reason for the selection of mosaic concrete as the facing of the tower.

Quartz, obtained from different sources, will be the principal aggregate material; selection of the quartz according to its color, and mixing the different lots of quartz to obtain the desired color gradation, will produce an exterior of strong contrast, from a dark shade at the base to a light rusty buff in the shaft, whose color becomes lighter and lighter toward the top. The base section will have mainly a vitreous aggregate; at the top some blue ceramic aggregates will be mixed with the quartz so as to cause the color to blend with that of the bulb or lantern surmounting the tower—this in order that the bulb may seem an integral part of the tower, the monument a monolithic unit.

"It is expected," say the architects, "that the glittering reflection of the quartz aggregate will blend with the glass bulb, which is faceted with diamond points. The darker colors at the base will produce an impression of stability and strength which is emphasized by the eight buttress-like columns as black as the night which the genius of Mr. Edison made shorter and more enjoyable for us through his inventions."

Ingenious use is made of the fac-

ing slabs as outer forms for the mass concrete or backing that will constitute the monument wall itself. The facing slabs, 2½ in. thick, 10 ft. long and of varying width depending on the detail, are so reinforced that they will be able to withstand the pressure of a 4-ft. depth of concrete backing placed in one hour. The slabs will be tied to the inside form, which is first erected, by wire ties fastened to loops of ⅜-in. round rods embedded in the slabs; the same loops serve to anchor the slabs to the backing concrete.

In this way the 10-in.-thick concrete walls of the tower will be built up in 10-ft. heights, corresponding to the height of a facing section. Rather heavier construction is required at the base, as the slabs forming the faces of the columns are about 17 ft. high, each cast in a single piece like the facing of the main body.

At the top of the tower the incandescent light bulb, 9 ft. 2 in. in diameter by 13 ft. 3 in. high, will be built of a steel frame carrying curved Pyrex glass sections or panes about 2 ft. square and 2 in. thick. The framing of the bulb and the attachment of the glass are so designed as to give adequate play for the expansion and contraction of the glass due to wide ranges of temperature.

Massena & duPont, of Wilmington, Del., the architects of the tower and Louis H. Doane, the structural engineer, have planned the construction

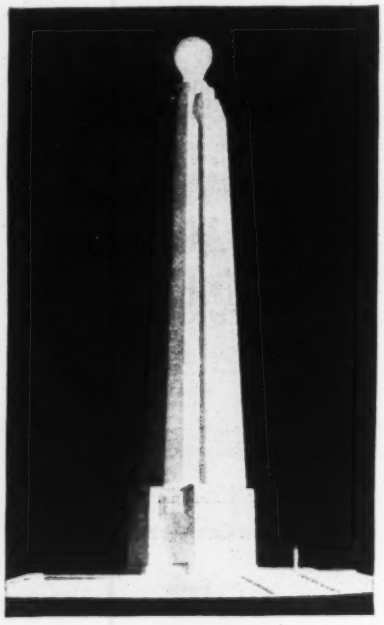


Fig. 2. Model of the Edison Memorial Tower, which will stand on the site of Menlo Park laboratory.

work so that the beacon light in the temporary tower hastily built for "Light's Golden Jubilee" in 1929 will continue to burn until the group of lights within the new glass bulb can be turned on to take its place. The new tower, now being built by Walter Kidde Constructors, Inc., New York, occupies the same site as the 1929 temporary tower, which is the site of the old Edison laboratory. The masonry will enclose the steel tower, and the latter is not to be taken down until the new tower reaches the level of the existing light structure. When this stage is reached the old light will be supported from the new structure and the steel tower taken down; later the new glass light bulb will be set in place of the light carried by the temporary tower. This changeover of lamps is to be carried out in such manner that light may shine out from the tower every night without interruption.

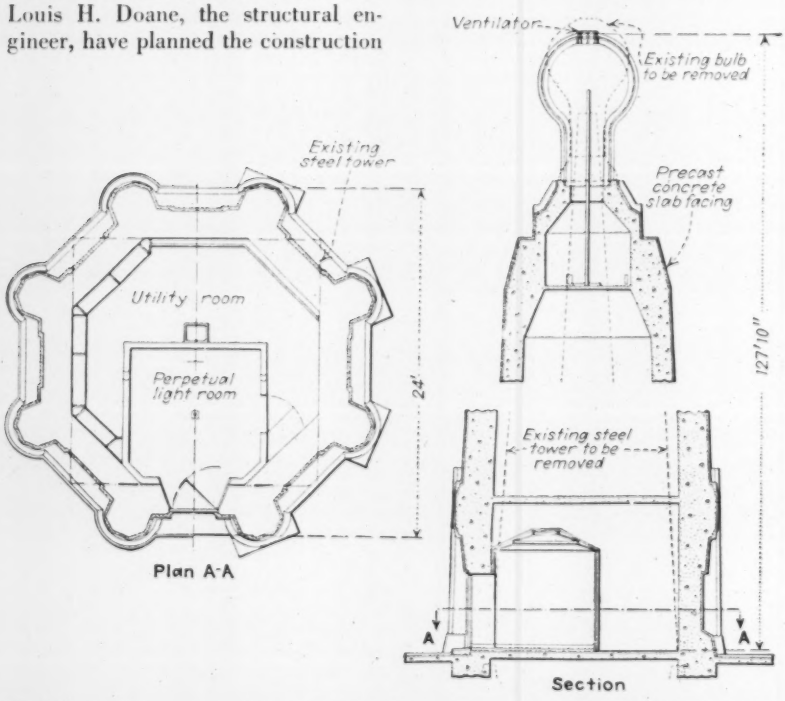


Fig. 3. As if to express Edison's originality, the tower being built at Menlo Park, N. J. as a memorial to Edison is original in its structural design and detail.

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To Study Accident Causes By Systematic Record

ACCORDING to an announcement of the American Standards Association, a committee of the Association has drafted a code for recording causes of accidents, which is shortly to be distributed for comment and criticism. The purpose of this code is to systematize the recording of accidents in simple but complete form with a view to giving the essential information from which the principal causes of accidents may be determined. The movement is based on the view that accidents do not happen, but are caused.

In addition to this new accident record code the Association is working on eleven new safety codes, including one for work in compressed air, one for cranes, derricks and hoists, and one for compressed air machinery and equipment. So far forty-seven safety codes or analogous specifications have been drafted or approved by the Association. Of special interest to engineering construction are specifications for fire tests, building exits code, safety code for floor and wall openings, railings and toeboards, safety code for ladders, safety code for elevators and recommended inspection practice, regulations for electric wiring and apparatus, national electrical safety code, colors for traffic signals, manual on uniform traffic-control devices, standard for railroad highway grade-crossing protection, specifications for drinking fountains and sanitary privies, safety codes for the prevention of dust explosions.

FIG. 1. A TARRED-GRAVEL ROAD THROUGH PINKHAM NOTCH TO CANADA CARRIES 940 VEHICLES A DAY.

New Technique in Road Honing

by LEROY F. JOHNSON

Maintenance Engineer, New Hampshire Highway Department, Concord, N. H.

Improved results in New Hampshire tarred-gravel road maintenance are being secured by special hones and honing methods

GRAVEL almost everywhere and disintegrated rock from the talus of its granite mountains and hills furnish New Hampshire with materials that when bound with a little tar make some of the finest light-traffic roads that can be found anywhere. Today about 80 per cent of the total mileage of the primary and secondary roads of the state is tar-treated gravel. Some of these roads are of an older design practice and a share of the present work consists of flattening crowns, widening, and other roadway modernization, but primarily the current work is resurfacing and maintenance.

A designed road

The tar-treated gravel road is not a haphazard structure, it is a designed road in every particular as the typical section and alternates of details shown by the drawings of Fig. 2 make evident. Considering primarily the surfacing structure, it is noted that it is laid in two courses and that a substantial depth of base course is provided; including the surface course, a 16-in. depth of gravel lifts the surfacing well above the general range of medium-type gravel-construction practice. The quantities per 100 ft. are about 90 cu.yd. in the base course and 30 cu.yd. in the course on the surface.

A feature of the base-course design is that at intervals of 200 ft., or as

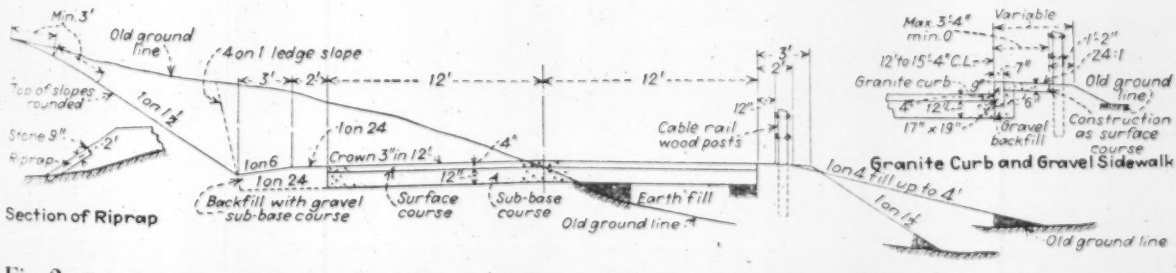

Fig. 2. **Tarred-gravel roads in New Hampshire are built to a fully designed section calling for two-course construction 16 in. deep over the subgrade.**

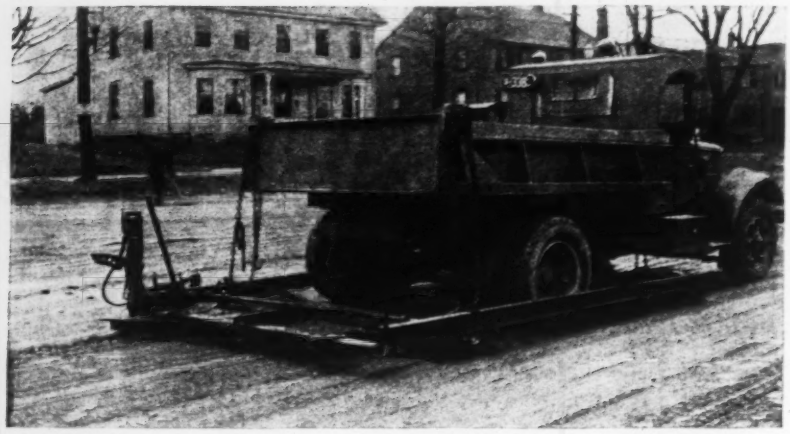

Fig. 3. Hone or maintainer hung under a truck is considered the best device for preparing tarred-gravel roads for tar retreatment.

directed, drain channels are provided through the earth shoulders. Generally the shoulders have a slope to ditch of ½ in. per ft. but on curves of over ½ in. per ft. of superelevation the shoulder continues the slope of bank or superelevation. Again referring to the base course, it will be seen that in rock cuts it is continued to the back slope to build the shoulder. So also where sidewalks are provided they are a continuation of top-course construction beyond a low concrete curb.

With the basic structure in mind, the major present operations on the large mileage of New Hampshire tarred-gravel roads are more readily understood. These operations are reconstructing old high-crown roads to modern cross-section and maintenance by honing and surface treatment with tar.

Cutting down the crown

The state's tarred-gravel roads have been constructed to various standards of design as has been said; the earlier ones with a high crown and without superelevation on curves. Where sufficient gravel was used in the construction of these roads, they are scarified by setting the roller teeth to penetrate about 3 in. into the surface. The tar mat is then machined a half to each side of the road and the road is put into proper cross section either by machining or by the addition of gravel; after this the tar mat that has been machined to the shoulders is machined back onto the road surface, wet with water and rolled. Then follows a ¼ gal. per sq.yd. application of tar having an Engler viscosity of 25 at 40 deg. C., which is covered with fine gravel and lightly rolled. Later, preferably in about two weeks, another ¼ gal. per sq.yd. of the same grade or a heavier tar is applied and honed either with a Connecticut hone or an under-truck maintainer (Fig. 3) and the surface is then lightly rolled.

Old road reshaped

The view shown as Fig. 4, taken in Winchester, N. H., shows the surface obtained where formerly a narrow high-crowned tarred road existed. The old surface was scarified and reshaped without the addition of gravel and the old tar mat was replaced as described above. This provided a uniform subgrade on which 6 in. of gravel was spread and roller compacted. As soon as ½ mi. had been completed, ½ gal. per sq.yd. of tar was applied and covered with fine gravel, and about two weeks later a second application of tar, ¼ gal. per sq.yd., was put on and covered with fine gravel containing about 60 per cent of ¼ to ½-in. stone at the rate of 50 lb. per sq.yd. This mulch was honed with an under-truck maintainer and rolled lightly. The cost of reconstructing 2½ mi. 21 ft. wide was $13,000.

Honing and tarring

The majority of maintenance is honing and applying new tar and a rather precise procedure is followed. So as to avoid detouring traffic, the general practice is to have a distributor apply 1/5 gal. per sq.yd. of tar until empty, on one-half the roadway, which would be a distance of from six to eight tenths of a mile. The bitumen is then covered with about 25 lb. per sq.yd. of fine gravel, and following the covering of this piece of road the opposite side of the highway is treated with the tar and covered.

Two types of hones (Fig. 5) are used. One is constructed either with four blades arranged in zigzag fashion or three parallel blades and is drawn behind a truck; the other is an under-truck maintainer (Fig. 3) that is suspended beneath the truck and is raised and lowered by a hydraulic pump which facilitates

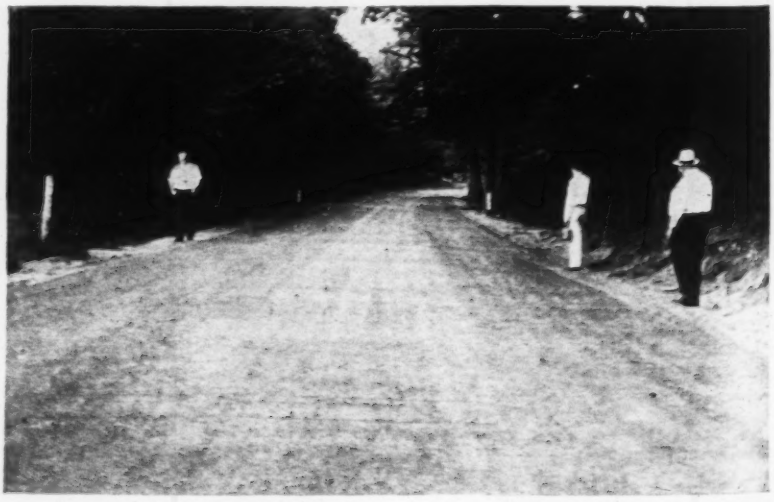

Fig. 4. High crowned road of old design at Winchester, N. H., cut down and widened to modern cross-profile at a cost of $13,000 for 2½ mi.

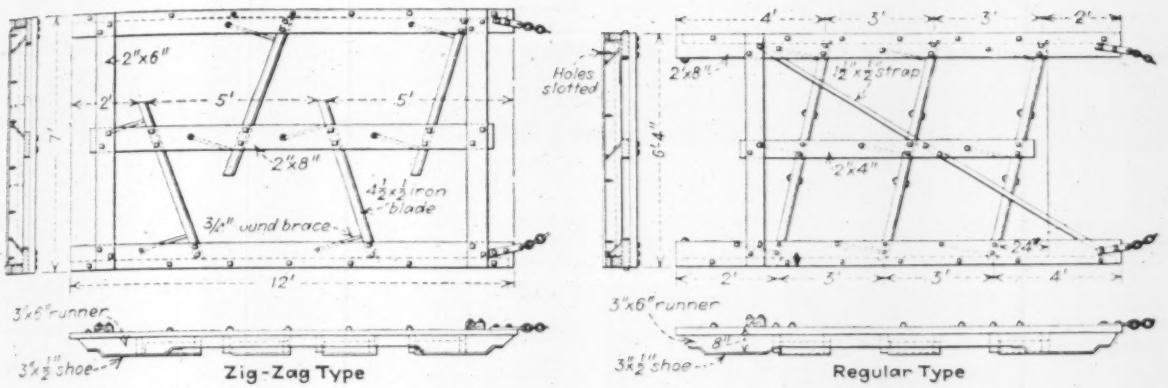

Fig. 5. Types of road hones used in regular maintenance of tarred-gravel roads in New Hampshire.

turning around. During the actual honing operation this maintainer rests directly upon the road surface; it is far superior to the other hones that have been used.

The honing operation consists of dragging the hone along the center of the road for the stretch covered by two distributor loads of tar, or for between 0.6 and 0.8 mi. Then follows a trip on each side, carrying the windrowed mulch toward the outer edge of the treated surface. To prevent the incorporation of loose shoulder material in the mulch, it is advisable not to bring the windrow nearer than 1 ft. from the pavement edge, as the honing operation is now reversed and the windrows are brought back toward the center of the roadway. Usually for a 20-ft. treatment one trip is made on each side with the hone dragging the windrows toward the center. Then a power grader, used because its direction can be controlled better than that of a hone, blades the windrows toward the center of the road, so that each windrow will parallel the center of the pavement with the edges of the two just touching. Next the power grader with its blade set about ½ in. above the road surface and at an angle of 90 deg. to the pavement center line, makes a trip along the center of the road. In finishing, the blade is set at an angle and the windrows are spread outward toward the edges of the pavement.

A 2,000-lb. road machine with the front axle and wheels removed trailed by a 1½-ton truck will do almost as effective work as a power grader. Where the under-truck maintainer is used the grader or road machine is not necessary since the maintainer can be controlled and has a tail gate that will spread the mulch as well as a power grader. The trucks used to drag the hones are 2½-ton rated capacity or heavier.

To remove waves and other irregularities the blade of the grader should not be raised or lowered while spreading, other than to avoid leaving a ridge in the completed work. If a road has a high crown no mulch should be left along the center of the pavement if the road is not superelevated the mulch should be carried to the outside of curves.

After the initial trip of the hone along the center of the pavement, fine sand spread lightly over the section honed will eliminate fat spots that otherwise might occur because of insufficient cover, or from overlapping tar applications. When all the mulch has been spread, the road surface should be covered lightly with a fine sand. To expedite the compaction of the mulch, ordinarily performed by traffic, Lawrence auxiliary roller wheels have been occasionally used.

Cost and comment

The following are costs per mile of surface treatment and honing for the year 1935:

Bitumen	$314.63
Sand and cover	103.90
Covering tar	60.24
Honing	27.40
	$506.17

The above costs cover the retreatment of 1413 mi. of road which was 55 per cent of the total surface-treated gravel mileage in the state system.

This method of honing has also been very satisfactory on old modified asphalt and penetration macadam roads, using ½ gal. per sq.yd. of cut-back tar covered with about 40 lb. of pea stone per square yard. The complete surface is rolled with a 10-ton roller.

By this method of honing, tar applications are not required as frequently, and at the same time the riding qualities and strength of surface-treated gravel roads have been greatly improved.

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Colorado Springs Real Property Inventory

In a real property inventory of Colorado Springs, Colo. completed last year by WPA there were 14,092 dwelling units of 12,406 structures enumerated. Owner-occupied were 6,062; tenanted, 6,739, and 1301 vacant. Single family detached houses were in the great majority, 89.68 per cent. Apartment buildings number only 61 or 0.5 per cent. Wood houses predominate, 83.84 per cent; stucco next, 11.77 per cent, and brick next, 3.33 per cent. Nearly half, 48 per cent of the structures were built prior to 1904. Only 41.37 per cent were in good condition, 37.48 needed minor repairs, 20.20 per cent needed major repairs and 114 or 0.95 per cent were unfit for habitation. This is a one-story city, 69.21 per cent being in that category, only 1 is over four stories high. Half have basements. Only 4.25 per cent are valued above $10,000 and but 34.72 per cent are mortgaged. The total cost of the inventory was $17,162, of which the city of Colorado Springs furnished the amount of $863.

An Engineer Revisits Wonderland

by FARLEY GANNETT

Gannett, Eastman & Fleming, Inc., Harrisburg, Pa.

An organized PWA is functioning smoothly without display, surplus functionaries or excessive red tape, finishing a job well done

In the Sept. 6, 1934 issue of Engineering News-Record, an article by Mr. Gannett was printed entitled "AN ENGINEER IN WONDERLAND" giving his experiences in the PWA offices in Washington, when the PWA was going through the pangs of organization. His present story is of today in the PWA.

— EDITOR

IT WAS the same southern lady of three years ago, still presiding over the reception room of the PWA in the Interior building in Washington, who greeted me recently as I walked into the restricted quarters which she now occupies alone. Gone was the great corner room, with its magnificent "oils" of forest, mountain and irrigated desert of our public domain; gone were the soft, deep rug, the many comfortable chairs for the many waiting petitioners (also gone) in which to do their waiting; gone was one of the two ladies who constituted the cordial reception committee; and gone were the hustle and turmoil of that great reception room of years ago. In its stead was an ordinary inside room, one window, one desk, a half dozen straight chairs and one attendant, kept not too busy by her occasional callers. These she tried to make comfortable and happy by her welcoming smile and desultory conversation, a soliloquy at times, I fear. The aimless passing and repassing of employees through crowded corridors was replaced by purposeful steps of officials and employees, who quite evidently seemed to know why and where they were going. The naval officer, who at one time was expeditor of expeditors, had been deposed as well as the expeditors themselves.

Very soon I was notified that I might see the assistant director, who occupied a plain and unostentatious office next door to the reception room. He received me quietly and smilingly and inquired how our jobs were progressing. We both sat down, lighted cigarettes and pipes and discussed the welfare of the nation and our mutual friends for awhile before we approached the matter which had brought me to Washington. All was quiet, dignified and businesslike. It took him two minutes to tell me who had such matters in charge, to telephone him and tell him I was on my way to see him. He didn't have to consult the printed list of employees, as he did in 1934. I found my man, discussed the question with him and received a prompt and definite answer. No buckpassing and no indecision. He knew his job and its authority and its limitations.

The first time I visited the PWA in 1934 there were 4 hr. of elapsed time between my brisk entrance and my wilted and bewildered exit. Of this time 30 min. were devoted to actual conferences and 3 hr. and 30 min. to waiting and walking from room to room through endless corridors. This time, edition of 1937, I was in the building 45 min. and devoted 30 of those minutes to talking to the men I came to see.

Everything is business

One has the feeling at this stage of one's visit to the PWA that things are running smoothly, that things are being done and have been done, that the time for promises, hopes and expectations is past and that there is a background of accomplishment to this PWA crowd and not just a future. It wouldn't be possible now, as it once was, to walk authoritatively and hatless and coatless into an official's private office and ask him for, and obtain, inside information because he mistook you for a higher official unknown to the one on whom you were calling. The PWA officials know each other now after three years of working for Mr. Ickes and they know a visitor from a fellow-employee. The atmosphere is no longer that of a promoter's office with a swell "front" but that of an executive office of a large business organization. Of course, there are many employees and a big overhead, but it's government and there must be checks and counter-checks, engineers, inspectors, accountants, special investigators, etc., and they have spread out over lower Washington in the same way that other departments have.

The PWA in a way represents the banker who has supplied money, other peoples' money, for public works. It wants to see this money properly and honestly spent. Its job is first to see that the project is wise and economically feasible, and a safe investment, then that the money furnished to the client goes where it was meant to go and accomplishes what it was intended it should accomplish. The purpose is not just to make jobs and spend money, it is a business proposition handled in a manner approaching a business way.

These passing years have seen the PWA select its projects from the standpoint of necessity and economic worth, and the financial ability of the borrower. These years have seen this money spent on such projects: schools, waterworks, sewerage systems, municipal buildings, state buildings, etc., and have seen these structures built and completed under contract, employing consulting engineers, architects and contractors; in other words, using the recognized

methods of getting good work done promptly and economically.

Job relations good

We have handled PWA work as engineers for municipalities, as contractors on a fee basis (on the first job to be built in our state), and we have been successful bidders on several other jobs—schools, dams, etc. We have seen the PWA change from a child, growing up too fast, making too much haste, getting into the natural difficulties of that period, into a man of mature age and experience, quite sure where he's going and when. As a rule those with whom we have come in contact in field, office and Washington have been earnest and hard-working; proud of their employer and of what is being accomplished.

We were paid promptly as a rule for what we did and an attitude of fairness to the contractor has been evident most always, particularly during later years. Few favors were granted unless proved to be fair and reasonable, but inspectors and engineers were not so imbued with bureaucratic importance nor so unbending, as in some of the older government construction organizations. Foolish things were done by ignorant men employed on jobs for which they were ill fitted. Some quickly learned or were promptly replaced. Some of the men who worked for us on PWA construction were drawn from the WPA rolls. They were the same men we have all seen doing as little for their wages as possible along the highways, etc. For us, under competent foremen, these men were energetic, interested and satisfactory employees. They wanted to work on a job whose usefulness they could understand and they were glad to work under intelligent and businesslike direction.

Closing the books

Paper work was multiplied, inspectors, auditors, engineers one by one or two by two visited the jobs from state, division and national headquarters. But the jobs were finished on time, were well and honestly done and cost little if any more than if done by the cities, municipalities, schoolboards, etc., without PWA supervision. It was public work done by business methods, labor had a real job, was fairly paid and gave a real day's work for its wage. Engineers and architects were given employment, contractors had work to do, many cities got needed improvements at low cost, and manufacturers had orders for machinery, cement, brick, steel, glass, etc. The PWA started the ball rolling among the employers of labor. It primed the pump by putting the priming water in the proper place to start the suction working and didn't pour it down the sewer.

And now those in control in Washington don't seem to appreciate this pump primer, this smoothly operating, practical and business-like organization, this assembly of trained and experienced engineers, architects, lawyers, professors, accountants, examiners and directors. They have stopped any further appropriations to this relatively economical and business-like organization.

In effect they are right, of course. The time has come for the PWA to pack up and retire, for conditions have changed since it was organized, and cities no longer need to be financed by Washington. Recognizing the changed situation, Congress has provided money to take care of applications already made, but nothing more, wisely recognizing that there is no further advantage in subsidizing local improvements since ample means are available to most cities and states for undertaking any works they may need or desire.

So the PWA is on the way out. But as it departs it deserves an appreciative farewell. It did, considering its hasty start and its necessarily complex overhead, a clean and businesslike job in first-class style, and if a federal job-making organization is now necessary at all, the PWA rather than the WPA would seem from many viewpoints, to be the one to stay.

Titanium Salts Used In Water Treatment

CONSIDERATION of the probable availability, cost and efficiency of various possible new coagulants in water treatment led to the study of titanium compounds according to W. V. Upton and A. M. Buswell, who reported their findings in a paper presented at the American Chemical Society meeting in Chapel Hill, N. C., on April 12.

The reagents used were: (1) an acidic solution of approximately equal parts of ferric and titanium sulphate obtained from ilmenite, (2) a dry mixture of iron and titanium sulphate (to escape the disturbing effects of excess acid), and (3) pure titanium sulphate. Two-liter water samples stirred mechanically were used in all experiments.

Coagulation studies on waters, to which had been given colors of 42-45 (platinum-cobalt scale) by addition of a dark brown industrial waste of vegetable origin and high salt content, were made with ilmenite extracts, ferric sulphate, and aluminum sulphate. Large amounts of all coagulants (11-17.5 grains per gallon) had to be used to obtain flocs, but the ilmenite extract gave the best results. Using waters colored with oak leaves to avoid the complications of high salt content, pure titanium sulphate gave better color removal than the iron or aluminum salt of low pH values, but at values above, good flocculation could not be obtained.

Fluoride removal experiments with the dry ilmenite extract gave no better results than those with aluminum sulphate.

To compare flocculation of aluminum and titanium sulphate at low temperatures, water samples were cooled nearly to zero degrees Centigrade and treated with 2 grains per gallon of coagulant fed in solution. The titanium sulphate gave considerably bulkier, faster settling floc. Several low temperature runs were made using 2 grain per gallon mixtures of the two coagulants. In general, the higher the titanium sulphate percentage in the coagulant the faster the floc settled and the less tendency there was to form a pin point floc.

The advantages claimed for titanium water coagulant are: (1) forms bulkier flocs very rapidly, (2) coagulates over wider pH range, (3) coagulates better in high dissolved salt concentrations and (4) gives better flocculation at low temperatures than aluminum or ferric sulphates.

THE WEEK'S EVENTS

Continued from page 251

Transmission Line Complete For Colorado Aqueduct

Completion of the 237-mile transmission line which will carry electric power from Boulder Dam to the five pumping plants on the Colorado River Aqueduct of the metropolitan water district of Southern California was announced July 26. The transmission line, which was started in December, 1935, was completed eight months ahead of schedule.

The 230,000-volt transmission system will eventually carry 36 per cent of all the firm power generated at Boulder Dam. The power will be used to drive the pumps to lift the aqueduct water a total height of 1600 ft. on the 392-mile line from the river to the coastal cities.

With the completion of the transmission line, the entire aqueduct project is about 64 per cent complete. Present plans call for the delivery of water to the aqueduct in 1939.

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S.P.E.E. Surveying Meeting Attended by Thirty

The first Surveying Teachers' Conference under the auspices of the Society for the Promotion of Engineering Education opened July 25 at Camp Marston of Iowa State College. The camp is located along the international boundary, 35 mi. east of International Falls, Minn. Thirty surveying teachers, representing various educational institutions in the country, are in attendance. Others are expected to attend the later sessions of the conference. Two periods daily of three hours each, are being devoted to the discussion of various topics on surveying teaching.

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Regional Directors Named For Park Service

To facilitate administration of the National Park and Monument System, Secretary of the Interior Ickes has approved the appointment of regional directors to coordinate the field work of the National Park Service.

Carl P. Russell, chief of the wild life division of the service, will be in charge of Region 1 with field headquarters at Richmond, Va. Thomas J. Allen, superintendent of Rocky Mountain National Park, Colo., will be in charge of Region 2 with field headquarters at Omaha. No appointment has been made to head Region 3 but Herbert Maier, now in charge of the park service of the Civilian Conservation Corps and emergency activities of Region 3, will be acting regional director of that region, temporarily continuing his field office at Oklahoma City. Frank A. Kittredge, chief engineer of the National Park Service, will head Region 4, continuing his field headquarters at San Francisco.

Oliver G. Taylor, deputy chief engineer, with headquarters in Washington, D. C., will succeed Mr. Kittredge as chief engineer and will continue at headquarters in Washington.

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Railroads Oppose Bridge At St. Louis

The Missouri Public Service Commission has been asked to deny the application of the city of East St. Louis, Ill., for authority to construct the western approach of its proposed toll bridge across the Mississippi River over the rights-of-way and easements of a number of railroad and ferry companies by those companies. The companies, the Terminal Railroad Association subsidiaries, the St. Louis Merchants Bridge & Terminal Railway Co., the St. Louis Transfer Co., and the Wiggins Ferry Co., contend that no public necessity exists at the present time for another toll bridge across the river as there are now three such bridges. It is further contended that if the bridge is constructed the western approach will seriously interfere with operations of the companies opposing the bridge.

The city of East St. Louis holds a Congressional grant to construct the proposed bridge which would cost about $3,500,000. The project would be constructed without cost to any of the corporations involved, but the Terminal Railroad Association, of which the three companies are subsidiaries, owns the Eads Bridge, one of the three existing toll bridges across the river.

Preliminary plans for the proposed bridge were prepared by D. A. Maney, consulting engineer of Evanston, Ill.

Foundations Found Good For Central Valley

The proposed dam sites near Kennett on the Sacramento River and at Friant on the San Joaquin River for the two big dams of the Central Valley project have definitely been proven sound, it was announced July 22 by the Bureau of Reclamation, as foundation exploratory work preliminary to construction was completed.

Solid rock has been reached in all of the holes, and studies of the cores have been made, permitting work to begin on completion of the final dam design.

Total penetration of the holes on the sites was 30,708 ft. of which 16,089 were driven at Kennett. Cores vary in diameter from 1½ in. to 3 ft. The deepest hole was at Table Mountain where the drillers had to penetrate 355 ft. to prove solid rock.

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California Voters to Act On Tax Diversion

The California state legislature has adopted a constitutional amendment to prevent diversion of gasoline tax funds to other than street and highway purposes. The proposed amendment will be submitted to voters at the 1938 general election.

The present measure is substantially the same as an initiative measure which was on the ballot at the last general election, except that certain provisions, which were considered responsible for its defeat at that time, have been changed. The new amendment omits reference to a tax on diesel fuel and contains a provision that if any highway funds be taken for the support of public schools, the sums so borrowed shall be returned to the highway funds.

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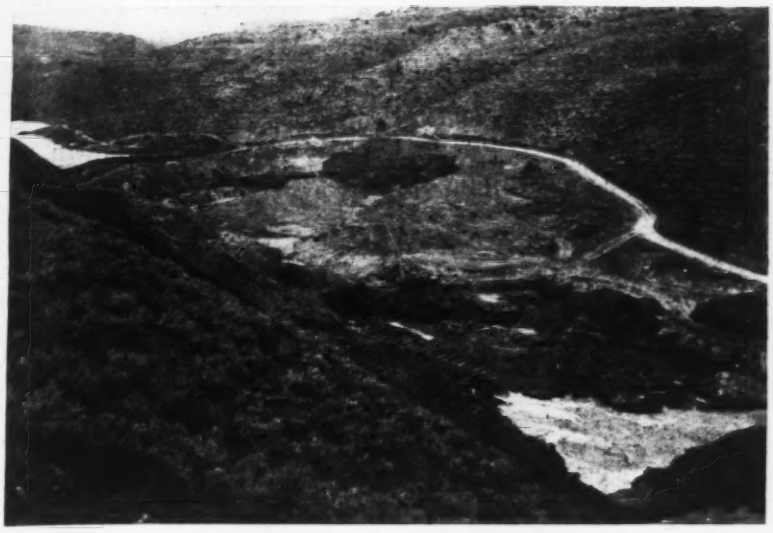
Steel Fabricators Bought By Dominion Corp.

The Dominion Steel and Coal Corp. of Montreal, a leading Canadian producer of steel, has purchased four Canadian subsidiaries of the U. S. Steel Corp. These are the Canadian Steel Corp., Ltd. of Ojibway, the Canadian Bridge Co., Ltd., of Walkerville, the Essex Terminal Railway Co., and Canadian Steel Lands Ltd., also of Ojibway.

Up to the present time, the corporation has been mainly interested in primary steel products, but the purchase of these new concerns, and especially the Canadian Bridge Co., will give it new outlets in the field of finished steel products.



PREPARING FOR A DAM

UNITY DAM, principal structure of the new Burnt River federal reclamation project, Oregon, will be constructed on this site by the Bureau of Reclamation. The dam will be 78 ft. high, 350 ft. long and will impound 25,000 acre-ft. of water to provide additional irrigation for 9,000 acres of land. It will be an earth embankment covered with rock fill.

Last Express Link Opened In Tri-State Highway

The last mile-long link in the Tri-State express highway which runs across Illinois from the Indiana to the Wisconsin line was opened to traffic July 27. The section just completed, at a cost of nearly $1,000,000, is part of the highway belt-line around the city of Chicago and is composed principally of elevated sections bridging the Santa Fe and C&E Railroad tracks, the Desplaines River, the Sag and the sanitary district canals, and the old Illinois & Michigan Canal. The new highway is a 40-ft. wide, 4-lane structure.

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More Money Allotted For Marshall Ford

An allotment of $5,000,000 from emergency funds for the fiscal year 1938 has been made for continuation of construction on Marshall Ford Dam, twelve miles above Austin on the Colorado River of Texas. Marshall Ford is one of a series of dams planned for the river by the Lower Colorado River Authority, a Texas agency. The other structures are being built by the authority, but the Marshall Ford Dam is being built by the Bureau of Reclamation as the federal government's contribution to the flood control program.

First stage of construction calls for a concrete masonry dam, 192 feet high and 2,285 feet long. A second stage, by which the dam would be raised to a height of 270 feet, may be undertaken in the future. Construction was begun with an allotment of $5,000,000 from the Emergency Relief act of 1935. The contract is held by Brown & Root, of Austin, and the McKenzie Construction Co. of San Antonio.

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New Seismic Code Available In California

Revised rules and regulations of the Division of Architecture of the California Department of Public Works pertaining to the administration of the state law governing the construction of public school buildings in California have just come off the press and are now available for distribution.

New items covered in the regulations include demolition, non-structural alterations, temporary buildings, identical buildings, and an entirely new regulation, Number 6, which creates an advisory board to the Division of Architecture to which appeal may be made when there is disagreement with the ruling of the Division.

Regulation Number 5, pertaining to the well-known provision for earthquake protection, has been materially revised in the light of experience gained during the past four years. The code is unusual in that it requires the designs be formulated on analytical methods of design rather than upon rule of thumb requirements.

Flood Control Bonds Passed For Santa Ana Project

Voters of Orange County, Calif., approved, by a vote of ten to one, a $2,500,000 bond issue which will make possible a $15,000,000 flood control and water conservation project on the Santa Ana River.

The county's bond issue will be met with $12,748,000 of federal funds administered by army engineers to be used in building eight flood control dams and other work on the Santa Ana. The county's contribution will be used for purchase of land and rights of way.

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U. S. Engineers Recommend Program for Willamette

A program of flood control, irrigation and navigation improvements in the Willamette Valley, Ore., at a cost of $56,875,000 is found to be economically justifiable in a report made by the U. S. Engineers. The Willamette Valley comprises the entire water shed of the Willamette River system and contains about 12,000 sq. mi.

The plan proposed by the army engineers calls for an expenditure of $46,940,000 by the federal government and an expenditure for land, easements and rights-of-way by local interests amounting to about $10,000,000. The program would include construction of seven dams and provision of a 6-ft. channel to the mouth of the Santian River and a five-foot channel to Albany.

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Silicosis Charges Reduced In California

A 75 per cent reduction in the silicosis surcharge rate on industrial compensation insurance was approved last month by the California Insurance Commission. The reduced surcharges are retroactive to June 1, 1937.

The dust hazard surcharges were imposed last year after a long series of hearings over the protest of numerous industries affected. Originally the California Section Rating Bureau proposed surcharges of $11.23 per $100 of payroll for underground mining, $14.04 for ore milling and $2.81 for surface mining. Because of the strong protest against these rates, the rates actually put into effect last year were $.56 for surface mining, $2.24 for underground mining and $1.40 for ore milling. Now these last surcharges have been cut by 75 per cent, which is taken as an indication of a trend towards elimination of the surcharges.

CALENDAR OF MEETINGS

NATIONAL SOCIETIES

CANADIAN GOOD ROADS ASSOCIATION, annual convention, St. Andrews-by-the-Sea, N. B., Sept. 7-9.

AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS, annual convention, Boston, Sept. 27-30.

AMERICAN PUBLIC WORKS ASSOCIATION, annual conference, Atlanta, October 4-6.

AMERICAN PUBLIC HEALTH ASSOCIATION, annual meeting, New York, Oct. 5-8.

NATIONAL COUNCIL OF STATE BOARDS OF ENGINEERING EXAMINERS, annual meeting, Scranton, Pa., Oct. 11-13.

NATIONAL SAFETY CONGRESS, Kansas City, Oct. 11-15.

REGIONAL AND LOCAL

SECTION MEETINGS, AMERICAN WATER WORKS ASSOCIATION, Central States, Dearborn, Mich., August 18-20; North Carolina, Wilmington, N. C., August 26-28; Rocky Mountain, Santa Fe, N. M., September 20-22.

PENNSYLVANIA SOCIETY OF PROFESSIONAL ENGINEERS, annual convention, Hershey, Pa., Aug. 21.

MONTANA BITUMINOUS CONFERENCE, annual conference, Glacier National Park, Sept. 7-9.

NEW ENGLAND WATER WORKS ASSOCIATION, annual convention, Poland Spring, Me., September 21-24.

ROCKY MOUNTAIN SEWAGE WORKS ASSOCIATION, first annual meeting, Santa Fe, N. M., Sept 20-23.

OFFICERS ELECTED

THE ENGINEERING SOCIETY OF DETROIT, at a recent meeting of the board of directors, elected the following officers: John H. Hunt, president; Harold S. Ellington, first vice-president; James W. Parker, second vice-president; Clyde R. Paton, secretary; and W. D. Cameron, treasurer.

J. B. CLAYTON is the new president of the St. Louis chapter of the American Public Works Association. E. H. Paffrath was elected first vice-president and F. F. Kernan became secretary-treasurer.

THE NEW ORLEANS chapter of the American Public Works Association recently elected the following officers: W. S. Rainville, Jr., president; A. E. Theard, first vice-president; R. B. Kohnke, second vice-president; and A. G. Wyler, secretary-treasurer.

30,000 Miles of Road Paved by States

State highway departments placed 28,913 miles of new highway surfacing in 1936, according to reports of state highway departments to the U. S. Bureau of Public Roads. High type surfaces accounted for 4,706 miles of this amount and 24,207 miles consisted of lower type surfacing.

About twice as many miles of highway were resurfaced as received entirely new surfaces. A large part of the resurfacing consisted of replacement of worn surfaces with higher types.

The rural primary state systems now include 340,160 miles. The year's work brought the surfaced portion to 289,103 miles or 85 per cent, consisting of 113,695 miles of high type surfaces and 175,408 miles of low type.

Gravel and similar surfaces now account for about 104,000 miles of the state highway system, and there are about 81,000 miles of portland cement concrete, 15,000 miles of bituminous concrete, 14,000 miles of bituminous macadam, and 34,000 miles of low-cost bituminous mixes. Brick and other block types account for about 3,000 miles.

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Highway Officials Meet in Denver

New President of the Western Association of State Highway Officials is Lacey V. Murrow, highway director of the state of Washington. Other officers elected at the Denver meeting last month were: Clyde Oden, vice-president, and James B. True, secretary-treasurer. Gibb Gilchrist, retiring state highway engineer of Texas was elected an honorary member of the association.

Addresses given included a discussion of Wyoming traffic surveys by J. E. Wiley of the Wyoming Highway Department, and a discussion of "Who should pay for the Highways" by Roy F. Britton, director of the National Highway Users. An address on the federal secondary highway system was delivered by L. I. Hewes, deputy chief engineer of the U. S. Bureau of Public Roads, a discussion of highway location in passes of the Colorado Rockies by Charles D. Vail, Colorado highway engineer, a progress report on the planning survey by H. S. Fairbank of the Bureau of Public Roads, and an address on uniform truck regulations in the western states by G. S. Paxon, Oregon bridge engineer. W. A. Klinger, president of the Associated General Contractors, and Willard Chevalier, president of the American Road Builders Association, delivered addresses.

PERSONAL

GLENN MATHIS, maintenance engineer of the Tennessee state highway department for the past 12 years, has resigned, effective August 1.

JACK HARRIS, for ten years assistant state highway maintenance engineer in Tennessee, has resigned, effective August 1.

H. O. BOYD has been appointed state highway maintenance engineer of Tennessee, replacing Glenn Mathis, resigned.

THOMAS H. MITCHELL has been made vice-president in charge of construction of the H. K. Ferguson Co. of Cleveland.

HOWARD EICHENBAUM, consulting architect for WPA has received a six months leave of absence to resume private practice of his profession.

H. S. DILCHER, acting district engineer for the WPA at Huntington, W. Va., has resigned that position to go with the Graver Tank & Mfg. Co. of Chicago.

FRED HARDY has resigned the position as assistant city engineer of Ironton, Ohio, which he has held since 1932 and he will take a position with the bureau of sanitation of the state of Alabama.

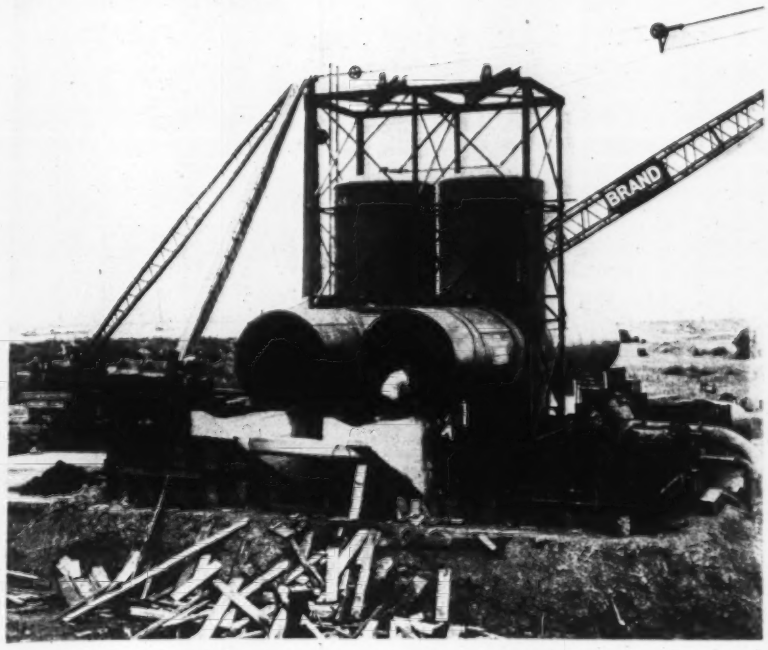
S. L. MACMILLAN has been named president of the Aberthaw Co., contractors of Boston, Mass., to succeed the late Leonard C. Wason. Mr. MacMillan was formerly vice-president of the firm.

LT. COL. JOHN S. BRAGDON, U. S. Engineers, was transferred August 1 from the headquarters of the New York division to the Providence office, to take charge of the Connecticut valley engineering and flood control work now beginning.

JULIAN MONTGOMERY, Texas state director of the PWA, has resigned that position to become general manager and consulting engineer for the Willacy County Water Control and Improvement District No. 1.

W. J. GILFILLAN, associate administrative assistant of the Memphis station of the U. S. Engineers since 1918, retired July 31, at the age of 70, after 46 years of service in clerical positions with the U. S. Engineer Department in the Middle West.

C. G. POLK has been appointed an associate highway engineer in the



WORK BEGINS ON NEW THAMES TUNNEL

WORKMEN put the finishing touches on the air locks for the pilot shaft of the new tunnel now under construction at London under the Thames River from Pursleep to Dartford. The tunnel, which has a length of more than a mile including its approaches, is expected to cost about $16,000,000. The present pilot shaft, 12 ft. in diameter and about 2700 ft. long, is being built by Charles Grand & Sons.

Plans have recently been announced for construction of a new tunnel paralleling the Blackwall tunnel 12 miles upstream. It will have a diameter of 24 ft., a length of 3,000 ft., including 1,200 ft. under the river, and will cost about $15,000,000.

office of the U. S. Bureau of public roads at Missoula, Mont., succeeding the late E. M. Hulce. Mr. Polk has been connected with the bureau since 1916, except for service in the army during the war.

EDWARD W. JONES has been appointed resident engineer in the Bureau of Construction of the Pennsylvania Department of Property and Supplies and will be in charge of repair and new building work for 25 Western Pennsylvania counties. Mr. Jones has been engaged in building work for the past 25 years.

T. F. KRAMER and A. F. RIDEOUT, have formed a partnership and will engage in a general engineering practice with headquarters at DeRidder, La. Mr. Kramer, who will assume the duties of chief engineer in the new partnership, has previously been connected with the Louisiana Highway Commission. Mr. Rideout, who has spent the past several years in Central and South America, will assume the routine duties connected with the organization.

Oversize Load Regulations Drawn in Indiana

Regulations governing the issuance of permits for the operation of oversize and overweight vehicles on the Indiana highways have been issued by the State Highway Commission.

Permission to use oversize equipment will not be granted for hauls of more than about 50 miles where there are shipping facilities. If there are no shipping facilities special consideration could be given. No application will be approved allowing vehicles to use posted roads or bridges if the weight of the vehicle is greater than the posted load, unless it is impossible to get to the destination any other way. If it is necessary to allow a heavy load to go over a posted bridge, it must be understood that the applicant will be held entirely responsible for any damage. Application to move heavy shovels and similar equipment over highways under their own power will be kept to a minimum and will never be granted for more than a mile or two if the machine can be hauled on a trailer.

OBITUARY

ADDISON R. TELLER, 57, cadastral engineer for the U. S. Department of the Interior at Denver, died July 20.

GEORGE J SCHELL, chief architect of Daniel H. Burnham & Co., and designer of many buildings in Chicago, died July 28 in Chicago at the age of 69. Mr. Schell had been connected with the Burnham Co. since 1891.

ELIOT M. MILLER, 83, for 30 years an assistant city engineer in New Orleans, died recently in that city. Before joining the city engineer department, Mr. Miller was active for five years in the New Orleans sewerage and water board.

RALPH W. VAIL, construction engineer, died July 28, at Springfield Lake, Ohio, at the age of 45. Mr. Vail had been connected, in construction and sales capacities, with the Goodyear Co., the Dravo Engineering Co., the American Shipbuilding Co., the Thew Steam Shovel Co. and Lima Locomotive Co.

ALEXANDER R. MCKIM, retired consulting engineer, died at Marblehead, Mass., July 28 at the age of 74. A graduate in 1885 of Massachusetts Institute of Technology, Mr. McKim had also studied at Columbia University and the Technische Hochschule of Berlin. He served as a consultant for numerous bridge companies and for the city of New York and later joined the engineering service of New York State, retaining that connection until his retirement in 1927.

MELVILLE F. CLEMENTS, who retired last March from his position as bridge engineer for the Northern Pacific Railway Co., which position he had held since 1916, died recently in St. Paul, at the age of 62. After his graduation in 1899 from the University of Iowa, Mr. Clements entered the service of the Burlington, Cedar Rapids, and Northern Ry., where he remained for two years. He then became chief draftsman for the maintenance of way department of the Chicago, Rock Island, and Pacific Ry., and after several years in that position and a year with the Clinton Bridge Co., he went with the Northern Pacific as draftsman on bridge design in 1907. With that company he advanced to the positions of inspector, assistant engineer and finally bridge engineer, which position he held until his retirement. Mr. Clements had practiced for several years as a consulting engineer on deep foundation work. He was the inventor of the sand shell island method of sinking caissons and used it successfully on the foundations of the Suisan Bay bridge and the Huey P. Long Memorial bridge.

CONTRACT UNIT PRICES

What contractors are bidding on different kinds of construction work

ROOSEVELT DAM CANAL

OWNER: U. S. Bureau of Reclamation; R. F. Walker, chief engineer, Denver.

PROJECT: Construction of earthwork, canal lining and structures for Roosevelt power canal and additions to diversion dam, Salt River project, 20 miles northwest of Globe, Ariz.

BIDS: Seven bids were opened June 24, 1937, ranging from the low of $78,750 to a high of $125,578, with contract scheduled for completion within 120 days after award.

LOW BIDDERS:

1. Gates & Huntley, Los Angeles, Calif..... $78,750
2. J. A. Terteling & Sons, Boise, Idaho..... 87,780
3. Macco Construction Co., Clearwater, Calif.... 88,300

Item	Quan.	Unit Prices (1)	(2)	(3)
1. Care river	l. s.	$2,300.00	$3,000.00	$3,000.00
2. Excav. canal, Cl. 1	12,700 c. y.	.70	.50	.60
3. Excav. canal, Cl. 2	3,000 c. y.	1.00	1.00	1.00
4. Excav. canal, Cl. 3	300 c. y.	2.00	2.00	3.00
5. Excav. canal struct. Cl. 1	200 c. y.	1.00	2.00	1.50
6. Excav. canal struct. Cl. 2	50 c. y.	2.00	3.00	3.00
7. Excav. canal struct. Cl. 3	70 c. y.	4.00	3.00	4.00
8. Excav., misc. diversion	2,800 c. y.	2.60	2.00	1.20
9. Remove conc. struct., lining	40 c. y.	8.00	10.00	5.00
10. Conc. dem., diversion dam	160 c. y.	6.00	5.00	5.00
11. Remove conc., tunnels	40 c. y.	50.00	40.00	50.00
12. Trim canal, conc. lining	5,300 c. y.	.20	.40	.35
13. Backfill, structures	1,950 c. y.	.50	.40	.30
14. Tamp backfill, struct's	300 c. y.	1.00	.40	.60
15. Conc., canal struct's	380 c. y.	25.00	25.00	50.00
16. Conc. canal lining	450 c. y.	20.00	25.00	25.00
17. Conc. apron, diversion	850 c. y.	20.00	25.00	14.00
18. Conc., tunnels	70 c. y.	15.00	25.00	40.00
19. Gunite	6,200 c. f.	1.00	1.50	1.60
20. Place reinf. bars	160,000 lb.	.03	.03	.02
21. Dry rock paving	100 s. y.	4.00	2.00	5.00
22. Drill, grout anchor	2,100 l. f.	.25	1.00	1.00
23. Erect timb. struct's.	1 m.b.m.	100.00	50.00	50.00
24. Install gate hoists	6,500 lb.	.10	.10	.10
25. Install misc. metal	180,000 lb.	.07	.10	.15

LEVEE CONSTRUCTION, CALIF.

OWNER: U. S. War Dept. Sacramento, Calif., Lt.-Col. L. B. Chambers, dist. eng.

PROJECT: Raising, strengthening and construction of 12 miles of levee on the Sacramento River, Cal., at Yolo bypass from Fremont weir to Sacramento Northern R.R., Knights Landing ridge cut, and training and south levees of Cache Creek.

BIDS: Six bids were received on each of the two sections into which the project is divided, and nine bids were received for the combined work in May 1937, ranging for the combined work from the contract low of $115,598 to a high of $199,757.

CONDITIONS: Work is scheduled for completion in October, 1938, at average monthly prosecution of 120,000 c.y.; minimum hourly wages stipulated at $1.25 for skilled and 60c. for common labor, and the contractor furnishing all labor, material and equipment.

LOW BIDDERS:

1. Haas, Doughty & Jones, and Marshall & Stacy, San Francisco, Cal. (contract).... $115,598
2. J. P. Immel, Ventura, Cal..... 135,354
3. D. McDonald, Sacramento, Cal..... 150,760

Item	Quan.	Unit Prices (1)	(2)	(3)
1. Levee embankment	1,264,000 c. y.	$0.0685	$0.0836	$0.097
2. Road gravel	182 c. y.	2.00	2.00	3.00
3. Concrete, Cl. A	51 c. y.	35.00	20.00	30.00
4. Reinforcing steel	2,995 lb.	.10	.10	.07
5. Corr. pipe, 12 ga., 18 in., coupler	52 l. f.	4.00	3.95	4.00
6. Corr. pipe, 12 ga., 24 in., coupler	1,858 l. f.	5.00	5.00	4.70
7. Corr. pipe, 10 ga., 36 in., coupler	294 l. f.	9.00	9.66	8.00
8. Corr. pipe, 10 ga., 42 in., coupler	700 l. f.	10.00	12.20	10.00
9. Corr. pipe, 10 ga., 48 in., coupler	290 l. f.	12.00	13.39	12.00
10. C. I. cutoff sheets, 12 ga., 49½x50 in	14 ea.	15.00	11.00	12.00
11. C. I. cutoff sheets, 12 ga., 60½x60 in	6 ea.	20.00	15.60	18.00
12. C. I. cutoff sheets, 12 ga., 73½x70 in	14 ea.	25.00	20.00	23.00
13. C. I. cutoff sheets, 12 ga., 42 in. pipe	4 ea.	25.00	20.00	25.00
14. Auto. drainage gate, 2x14 ft	1 ea.	150.00	133.13	150.00
15. Auto. drainage gate, 2x18 ft	1 ea.	150.00	133.13	155.00
16. Auto drainage gate, 3x20	1 ea.	300.00	266.55	300.00
17. Auto. drainage gate, 3x16 ft	1 ea.	300.00	266.55	300.00
18. Auto. drainage gate, 3½x20 ft	3 ea.	425.00	382.10	450.00
19. Auto. drainage gate, 3½x6 ft	4 ea.	125.00	98.85	130.00
20. S. H. gate, 24 in., 6 ft. frame	1 ea.	50.00	41.33	50.00
21. S. H. gate, 48 in., 8 ft. frame	1 ea.	130.00	113.41	150.00
22. Auto. drainage gate, 24 in.	4 ea.	45.00	57.00	75.00
23. Auto. drainage gate, 36 in.	1 ea.	100.00	71.55	100.00
24. Wooden spill box	260 b. f.	.10	.10	.08

NEW MEXICO HIGHWAYS

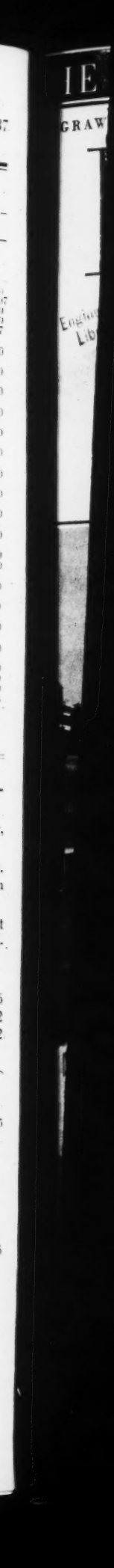
OWNER: U. S. Dept. Agriculture; J. A. Elliott, engineer, Denver, Colo.

PROJECT: Grading, surfacing and drainage of 3.278 mi. of 22 ft. highway of the Carrizozo-Roswell Forest system in Lincoln National Forest, N. M.

BIDS: Six bids were opened May 1937, and contract awarded June 1937. The proposals ranged from the contract low of $63,116 to a high of $79,694.

LOW BIDS:

1. Skousen Bros., Albuquerque, N. M. (contract) $63,116
2. Lee Moor Contracting Co., El Paso, Texas.... 70,132
3. Dudley Stone Products Co., El Paso, Texas.. 70,832

Item	Quan.	Unit Prices (1)	(2)	(3)
1. Excav. unclass	68,000 c. y.	$0.22	$0.27	$0.30
2. Excav. struct. unclass	2,270 c. y.	.75	1.00	.80
3. Excav. borrow, unclass.	12,000 c. y.	.20	.27	.20
4. Special overhaul	135,000 sta. y.	.02	.005	.025
5. Special overhaul	2,500 c. y. m.	.20	.30	.10
6. Gravel base, heavy, 3 in.	8,000 ton	.65	.55	.60
7. Crusher-run top course	4,000 ton	.75	.63	.80
8. Supplemental gravel	200 ton	.70	.63	.80
9. Watering	500 m. gal.	.75	1.00	2.00
10. Operate roller	15 day	20.00	20.00	16.00
11. Furnish roller	1 ea.	50.00	100.00	500.00
12. Furnish water plant	l. s.	50.00	800.00	100.00
13. Conc. Cl. "A"	608 c. y.	17.50	19.25	18.50
14. Conc. Cl. "B"	36 c. y.	17.50	17.00	18.50
15. Conc. Cl. "D"	87 c. y.	20.00	22.00	18.50
16. Reinf. steel	68,900 lb.	.048	.05	.055
17. Struct. steel	77,200 lb.	.064	.067	.05
18. Cement, Cl. "A", masonry	110 c. y.	15.00	18.00	15.00
19. Corr. metal pipe, 24 in.	350 l. f.	2.90	3.25	2.75
20. Corr. metal pipe, 30 in.	376 l. f.	3.75	3.90	3.55
21. Corr. metal pipe, 36 in.	340 l. f.	5.50	6.20	5.35
22. Pile treated timber	1,620 l. f.	1.00	1.60	1.50
23. Test pile	2 ea.	100.00	100.00	45.00
24. Loose rip-rap	150 c. y.	2.50	6.00	2.00
25. Barbed wire fence	34,000 l. f.	.06	.07	.05
26. Gates, 12 ft	30 ea.	10.00	16.00	12.00

(*Additional Contract Unit Prices on second following page*)